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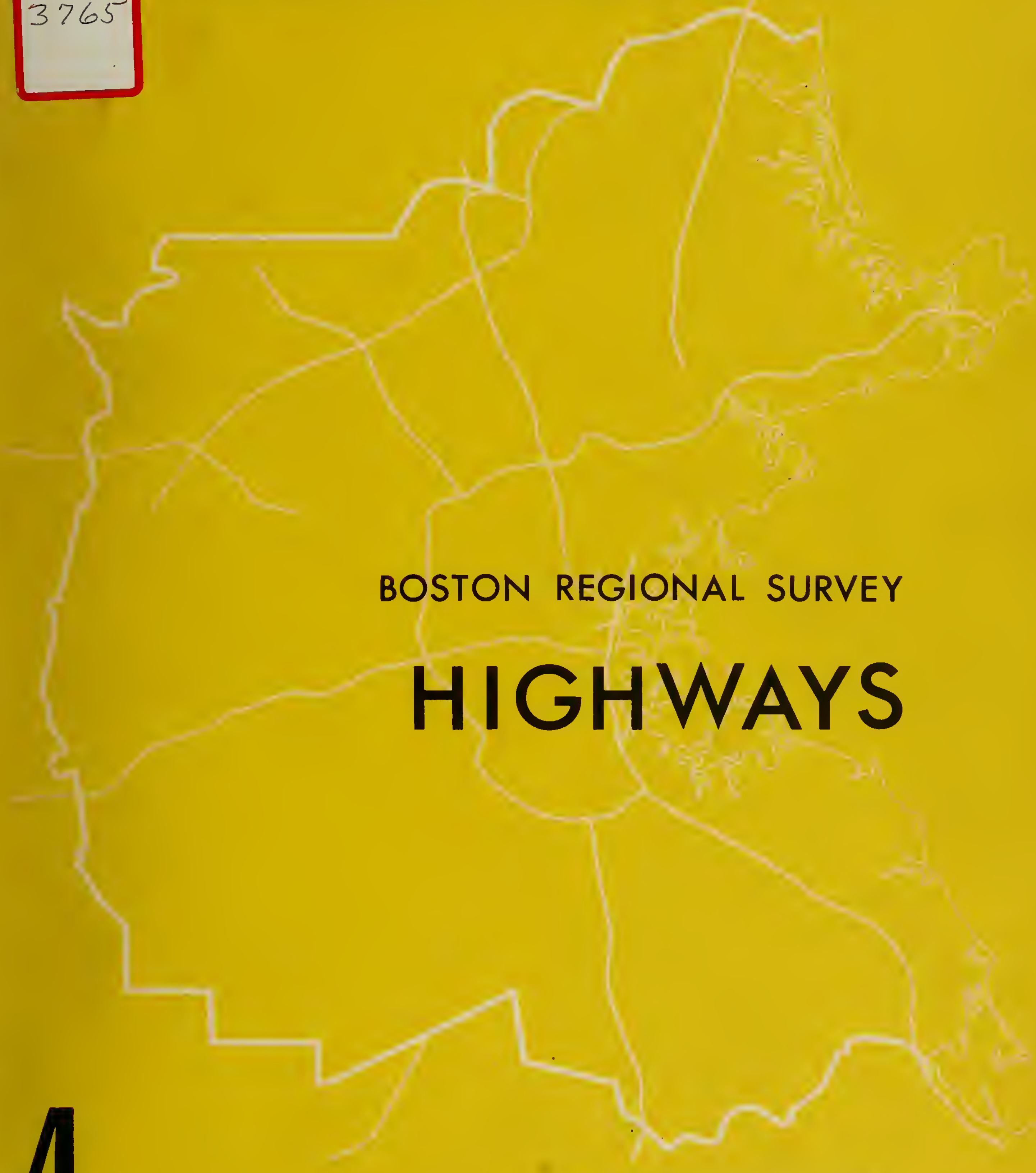

BOSTON REGIONAL SURVEY

HIGHWAYS

4

THE PLANNING SERVICES GROUP
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THE BOSTON REGIONAL SURVEY

TRANSPORTATION INVENTORY: CHAPTER FOUR

HIGHWAYS

NOVEMBER, 1962

Prepared for the
MASS TRANSPORTATION COMMISSION
COMMONWEALTH OF MASSACHUSETTS
120 Tremont Street
Boston, Massachusetts

by

THE PLANNING SERVICES GROUP

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THE BOSTON REGIONAL SURVEY

LIST OF PUBLICATIONS*

I. A BIBLIOGRAPHY OF PLANNING STUDIES (May, 1962)

II. REGIONAL OVERVIEW

- CHAPTER ONE: POPULATION (June, 1962)
- CHAPTER TWO: LAND USE (June, 1962)
- CHAPTER THREE: ECONOMIC BASE (July, 1962)

III. TRANSPORTATION INVENTORY

- CHAPTER FOUR: HIGHWAYS (November, 1962)
- CHAPTER FIVE: PUBLIC TRANSPORTATION (July, 1962)
- CHAPTER SIX: RAILROADS (August, 1962)
- CHAPTER SEVEN: PORTS AND AIRPORTS (October, 1962)

IV. COMPREHENSIVE SUMMARY AND ANALYSIS

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THE BOSTON REGIONAL SURVEY

INTRODUCTION

In July, 1961, the Mass Transportation Commission initiated a basic planning study of the Boston Metropolitan Region. The objectives of this project, the Boston Regional Survey, are (1) the preparation of a comprehensive inventory of planning studies of the region, and (2) analysis of regional research and proposals with respect to transportation, population, land use patterns, economic development, and other factors.

The Boston Regional Survey is designed as an introduction to the Mass Transportation Commission's comprehensive planning and transportation program for the Boston region. These major efforts, in contrast to the present survey which concentrates on a review and analysis of available reports and data, will involve the gathering of considerable amounts of new information on travel patterns and related phenomena as well as the preparation of development plans for regional land use and transportation.

Organization of the Survey

The Boston Regional Survey and the publications resulting from it have been organized into four main phases:

1. Assembly and summarization of information on all major plans and research studies of the Boston region. This phase culminated in publication of an annotated bibliography in May, 1962. A supplement will be issued upon completion of the Regional Survey.
2. An overview survey of the foundation elements of regional development. The three chapters in the overview phase include the three inventory topics considered basic in planning: population, land use, and economic base.

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3. An inventory of the principal regional transportation systems, to provide an understanding of the ways in which these systems have developed and the prospects for change. The four chapters in this phase cover public transportation, the railroad system, ports and airports and the highway system, subject of this report.
4. A final report of the Survey integrates materials from the three preceding phases into an analysis of regional development prospects, and is designed to serve as the basis for subsequent planning efforts by the Mass Transportation Commission. Included in the final report of the Survey will be one element of substantial significance to regional development patterns - an analysis of private and community decision factors in the choice of transportation alternatives. This includes an analysis of political, social and economic factors relating to transportation, and an evaluation of regional amenities and aesthetics as these relate to choice of transportation modes. Originally cited as Chapter Four: Decision Factors, this material will be included as a part of the final analysis.

The Study Area

The area selected for study in the Boston Regional Survey has been termed the Boston Metropolitan Region. In general this is the area referred to in this report as the "region" or the "Boston region." The area is bounded on the north by the New Hampshire border and on the west it follows roughly a line one tier of communities outside Interstate Route 495, the so-called Outer Belt. In the south, the region borders on the State of Rhode Island and the Southeastern Massachusetts Planning Region (Bristol County) while to the east the waters of Massachusetts Bay define the region.

Scope of This Report

The region's highway or road system accommodates the majority of the total trips generated by its 3.3 million inhabitants in the core area as well as the suburbs. The major proportion of transportation funds in the region are allocated to the highway system. Most of the region's goods and passenger movements utilize motor vehicles.

This report begins with a brief historical background of the highway system and proceeds to a review of previous studies that have had significant effects in shaping the region's highway and expressway network. This is followed by an inventory of the highway system and traffic parameters such as vehicle registrations, car ownership ratios, highway capacities and volumes. Another chapter discusses the role of the various highway construction agencies operating in the Boston region. Concluding the report is a review of the status of the expressway system and an overview of the major highway problems currently facing the region.

This report on highways is not intended to be a basis for highway proposals. It is concerned with a review of highway history, trends and current patterns, identification of major highway problems, and analysis of the implications of the highway system to which the region is presently committed.

The first highway law in Massachusetts (1639) was modeled after one that had been enacted in Virginia about 17 years earlier, based upon a statute labor system known as "working out the road tax." This law was supplemented by donations, assessments on adjacent properties, fines for failure to perform statute labor, and a variety of other methods aimed at constructing and maintaining the sketchy, primitive highways of 17th century Massachusetts. By 1650 some local governments in New England used the power of local taxation to raise funds for highway construction.

Until the late seventeen century Massachusetts public roads were mainly horse paths except near population centers, where the roads were constructed to carry carts and wagons. Many of the old roads in the region followed the routes of Indian trails.

One of the first Indian trails to be developed as a major colonial route in the 1630's was the Connecticut Path which extended westward from Cambridge to the Connecticut River valley in the Springfield area. This route passed through Wayland, Framingham, Sturbridge and Springfield. A section of roadway in Wayland still retains the name "Old Connecticut Path." This route was eventually extended toward the Hudson River and Albany. In the 1670's this colonial route was known as the upper Boston Post Road. The same general route was followed by federal primary Route 20, and more recently by the Massachusetts Turnpike.

Turnpikes, 1800-1850

Before the Revolutionary War, England hindered the development of early land transportation routes in the colonies as part of its policy of restricting intercolonial trade. Roads leading from the coast into the interior as well as routes parallel to the coast were in a thoroughly inadequate condition when the Revolutionary War ended.

There was no prospect of corrective action because there were no organizations empowered to build and maintain roads beyond local boundary lines. To remedy this deficiency, private turnpike companies were formed and chartered in Massachusetts by the Commonwealth. The turnpike companies were given the right of eminent domain in constructing these roads with toll rates, the number and the location of gates included in the terms of the charter.

Roads constructed by the turnpike companies were to revert to public ownership when investors had been paid back their first investment plus 12 per cent. The expected life of the turnpike corporations was 20 years. However, no turnpike in Massachusetts approached these goals of time and profit. In fact, the Salem Turnpike, the most successful turnpike investment, paid only a 3.1 per cent return over a 60-year period. Some turnpike investors received major rewards from the beneficial effects of the improved roads on local towns and businesses.

Turnpikes in the Boston region included:

The Salem Turnpike was built at a cost of $182,000 for 12 1/2 miles. The per mile cost of $14,600 was considered extremely high for turnpike construction. During its peak day, which occurred in 1813, it carried 120 stages. In 1868 it became a public highway.

The Norfolk and Bristol Turnpike connected Boston and Dedham and is now Washington St. between Forest Hills and Dedham.

The Medford Turnpike, connecting Boston and Medford, is now Mystic Avenue.

The Newburyport Turnpike, because of its straight line layout, encountered grade problems and by-passed population centers. As a result the road fared poorly, returning only two per cent to investors. As late as 1907 the

State Highway Commission refused to take over responsibility for this highway because of these bad features.

Other turnpikes include the Essex, Blue Hill, Cambridge and Concord, Middlesex, and Watertown Turnpikes. Figure 1 shows the turnpikes as they existed at about the middle of the nineteenth century.

One of the stated aims of the turnpike companies was to build roads in a straight line. The twisting alignment of the existing roads was frequently cited by petitioners as the reason for building the new roads. However, in their zeal to adhere to straight alignments many of the turnpike builders neglected to consider the detrimental effects of excessive grades despite general agreement that horses could not efficiently haul wagons at grades steeper than five per cent. Furthermore, in attempting to connect distant cities with straight lines the turnpike builders by-passed population centers that would have added substantially to their traffic volume and revenue.

Remaining vestiges of the turnpike period characterized by straight alignment can be found in the region. These include Washington Street near the Dedham line, the Newburyport Turnpike along most of its length, sections of the Worcester Turnpike, and a four-mile straight section along existing Route 1 from Route 140 in Foxboro to Plainville. Examples closer to Boston include Mystic Avenue, Broadway in Chelsea, Route 107 in Revere, Commonwealth Avenue, Brighton Avenue, North Beacon Street, and part of Route 2 along the Belmont-Arlington line.

1850-1900

The emphasis on privately owned toll road companies and the advent of the steam railroad, which quickly became the preferred mode of transportation, produced a period during which government aid to road-building was minimized. Through most of the nineteenth century intercity

BOSTON REGIONAL SURVEY

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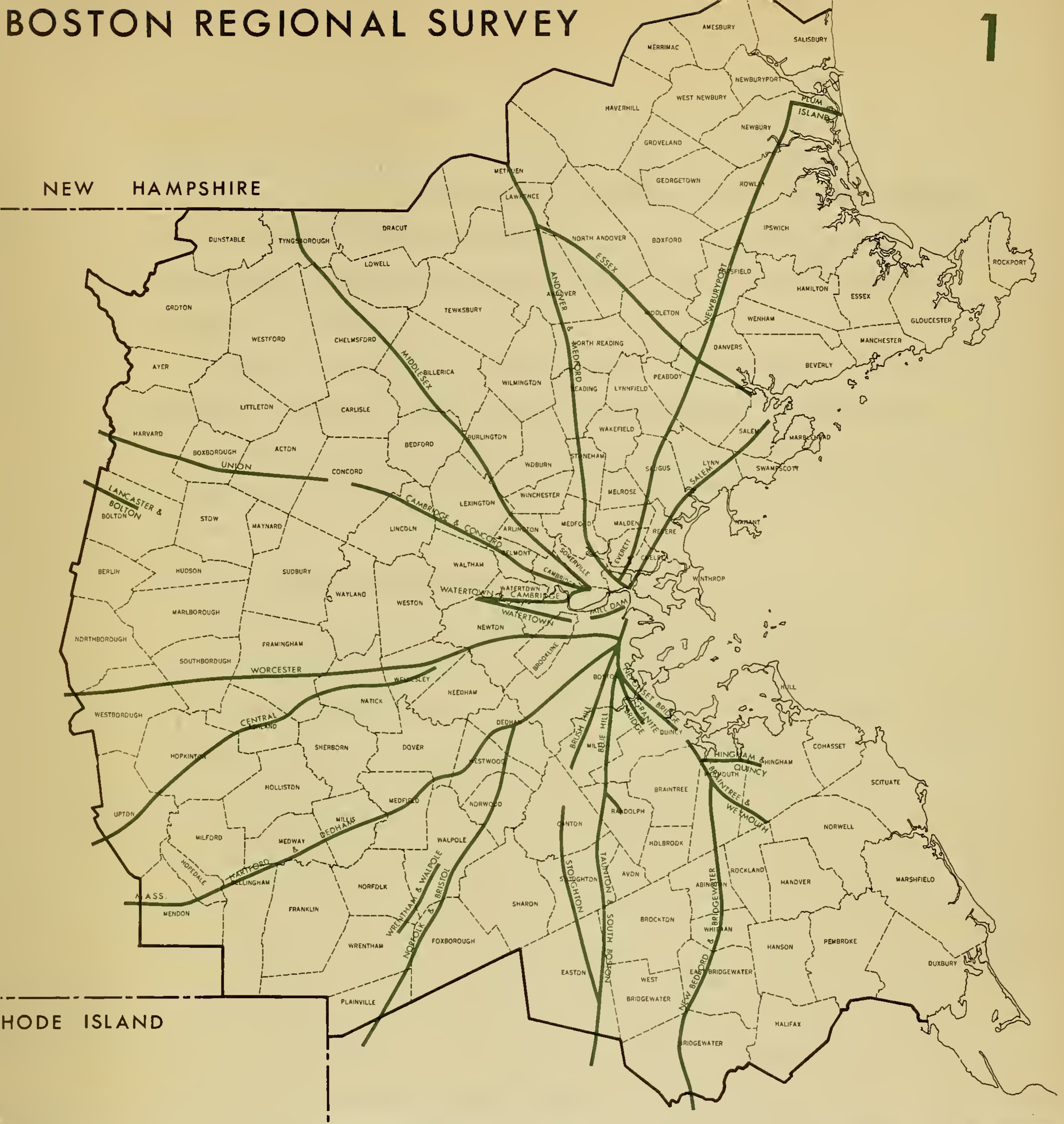

EASTERN MASSACHUSETTS TURNPIKE DEVELOPMENT, 1850

SOURCE: TURNPIKES OF NEW ENGLAND

GENERAL INFORMATION

- ☐ EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- ☐ MAJOR HIGHWAYS
- ☐ SECONDARY HIGHWAYS
- ☐ MAJOR RAILROADS
- ☐ SECONDARY RAILROADS
- ☐ RAPID TRANSIT LINES

NORTH

1 | 256D ACRES

SQUARE MILES

0 5 10 MILES

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public road construction was at a virtual standstill. As a result, the period between the end of the toll road era (about 1850) and the beginning of a Massachusetts state road-building agency in 1893 was marked by a gradual deterioration of the highway network. This trend was common throughout the nation.

Finally, toward the end of the nineteenth century intercity connections had deteriorated to the point where state governments throughout the country were forced to take on road-building responsibilities. Massachusetts was a leader; it was the second state to organize a state roads department.

The State Highway Department

A bill establishing a State Highway Commission was approved by the legislature in 1893. The bill provided that proposed roads be petitioned for by County Commissioners and be approved by the State Highway Commission. A separate bill for the construction of each road had to be submitted to the legislature for financing. However, a year later the legislature enlarged the powers of the Commission by allocating to it a sum of $300,000 to be used without further legislative action in constructing state highways. In 1894 the Commission requested petitions from local governmental agencies. At total of 108 petitions were received out of which thirty sections of road were approved and built in various parts of the state. A limit of two miles of improvements per community was established to extend limited funds and to demonstrate to local communities the latest advances in road building techniques.

Before the turn of the century the State Highway Commission developed a plan to connect the major cities with high-quality roads. In some instances the roadway width of the state highways constructed before 1900 was

18 feet but more often it was only 15 feet. In other cases, single lane, nine-foot roadways were built with frequent double-width sections to permit passage of carriages. By 1899 a total of 250 miles of state highways had been completed.

The general policy of the Highway Commission was to concentrate on rural highways and on the main routes used for travel between the largest cities and towns. Although many of these roads led to the city of Boston, only 3.6. miles of state highway had been laid out within Suffolk County (Boston) by 1915 out of a total of 880 miles of completed state highways.

By 1910 the Highway Commission developed plans for a complete system of state highways. The Commission plan called for linking all major population centers by a network of high quality state-maintained roads. Ultimately construction of intercity roads within the state resulted in routes which traversed the entire state and which connected with highways in adjoining states.

Because each state was initially interested in its own internal roads, there was a complete lack of coordination in constructing main interstate roads. In 1916 the Federal Aid Road Act was passed which provided federal funds for highway construction. The objective was the establishment of a comprehensive system of interstate roads.

In 1919 Massachusetts responded to rapidly increasing demands for improved and expanded highways by adoption of Chapter 350 of the General Acts. This provided for a Department of Public Works to be in charge of state highway construction among other activities. By 1920 state highway mileage totaled 1,394 miles, a gain of over 50 per cent since 1915. Table 1 shows the amount of new highway mileage built by the DPW between 1920

TABLE 1

STATE ROAD MILEAGE CONSTRUCTION TRENDS IN MASSACHUSETTS 1923 - 1960

Period	Total Mileage Built by the DPW	Total Mileage in Highway System at end of Period
1923 - 1925	253	1,542
1926 - 1930	572	1,624
1931 - 1935	605	2,107
1936 - 1940	491	1,890
1941 - 1945	257	1,917
1946 - 1950	972	1,988
1951 - 1955	1,038	2,188
1956 - 1960	688	2,385

Source: U.S. Department of Commerce, Highway Statistics, 1955 Summary and 1956 to 1960 annual volumes; (Washington: U.S. Government Printing Office).

and 1960. The total mileage in the state highway system at the end of each five year period is also shown. By 1920 most of the state highway system had been laid out. New construction after 1920 far exceeded additions to the state highway system. This DPW construction has consisted of upgrading existing roads and building new state highways while discontinuing older, by-passed sections of road. In the 1930's the DPW constructed a number of high-quality roads. These included the Newburyport Turnpike from Danvers to Newburyport and a 12 mile portion of the Boston-to-Worcester Turnpike from Southborough to Worcester. This section of highway, built of cement concrete and 40 feet wide was a forerunner of the high-quality rural highways built throughout the region during the 1930's.

During World War II (1941-1945) state highway construction and planning was decelerated. Less than a month after the conclusion of the war, however, a study was iniated to make recommendations for comprehensive highway improvements in the Greater Boston Area. This study resulted in a report prepared in 1948 entitled The Master Highway Plan. This report proposed a system of radial expressways leading from the city of Boston to suburban communities and leading eventually to other major cities in New England. In addition, two circumferential routes were recommended: (1) an inner loop around the downtown area of Boston, and (2) an outer loop approximately ten miles outside the downtown area. Only a small portion of the Inner Belt has been completed but most of the outer circumferential Route 128 had been completed by 1957.

Route 128 followed an existing route in many sections and in other sections followed a completely new alignment. The alignment was designed to avoid the heavily populated outlying community centers and was to connect at a distance from the Boston area, all the arterial expressways

leading out of the city. Referred to by some as "the highway that goes nowhere," soon after its construction Route 128 became famous for the impressive industrial growth along the route.

At the present time there is considerable expressway construction in the Boston region. In addition to the Interstate projects currently underway, federally aided primary and secondary routes in the region are being improved by the state Department of Public Works. The Department is also engaged in numerous planning activities.

A major planning effort of the DPW has been the recently published Inner Belt and Expressway System Report. The Department is also participating in the Mass Transportation Commission study of the Boston region. For the first time in this region and one of the first instances in the country, a state highway organization is participating in a coordinated planning effort involving both the highway system and the mass transportation system.

2. REVIEW OF REGIONAL HIGHWAY STUDIES

Unlike the region's transit and railroad systems, the expressway system built, under construction, or proposed for the region has been based on extensive planning studies of highway requirements. During the past 30 years, five major highway studies have been prepared in the Boston region. These are the Report on a Thoroughfare Plan for Boston (the Whitten Report) published in 1930 by the Boston City Planning Board; three Department of Public Works studies: the 1948 Master Highway Plan, the Report on Traffic Studies for the Boston Metropolitan Area, published in 1957, and the Inner Belt and Expressway System Study published in 1962; and a study entitled Travel in the Boston Region 1959-1980, published in 1958 by the Boston College Seminar Research Bureau.

All of these studies have assumed that a major public transportation component would absorb future peak demands in heavily traveled transportation corridors which could not conceivably be accommodated by highways. However, while the concept of total transportation planning has long been recognized, no major study has successfully developed a comprehensive plan integrating the various elements of the region's transportation system.

Regional, or metropolitan area transportation studies have evolved in the Boston area in much the same way as have advances in highway design. Early studies, made by the city of Boston, included only the city as the area of critical concern. Later studies enlarged their sphere to include areas that were considered to be part of the Boston metropolitan area. Figure 2 shows the areas included in the major highway reports. Each of these studies dealt with large segments of the region. Even the 1930 Whitten report, which was primarily concerned with improvements within Boston, related these improvements to a larger system of metropolitan and state highways and parkways in areas to the north, south and west of Boston.

BOSTON REGIONAL SURVEY

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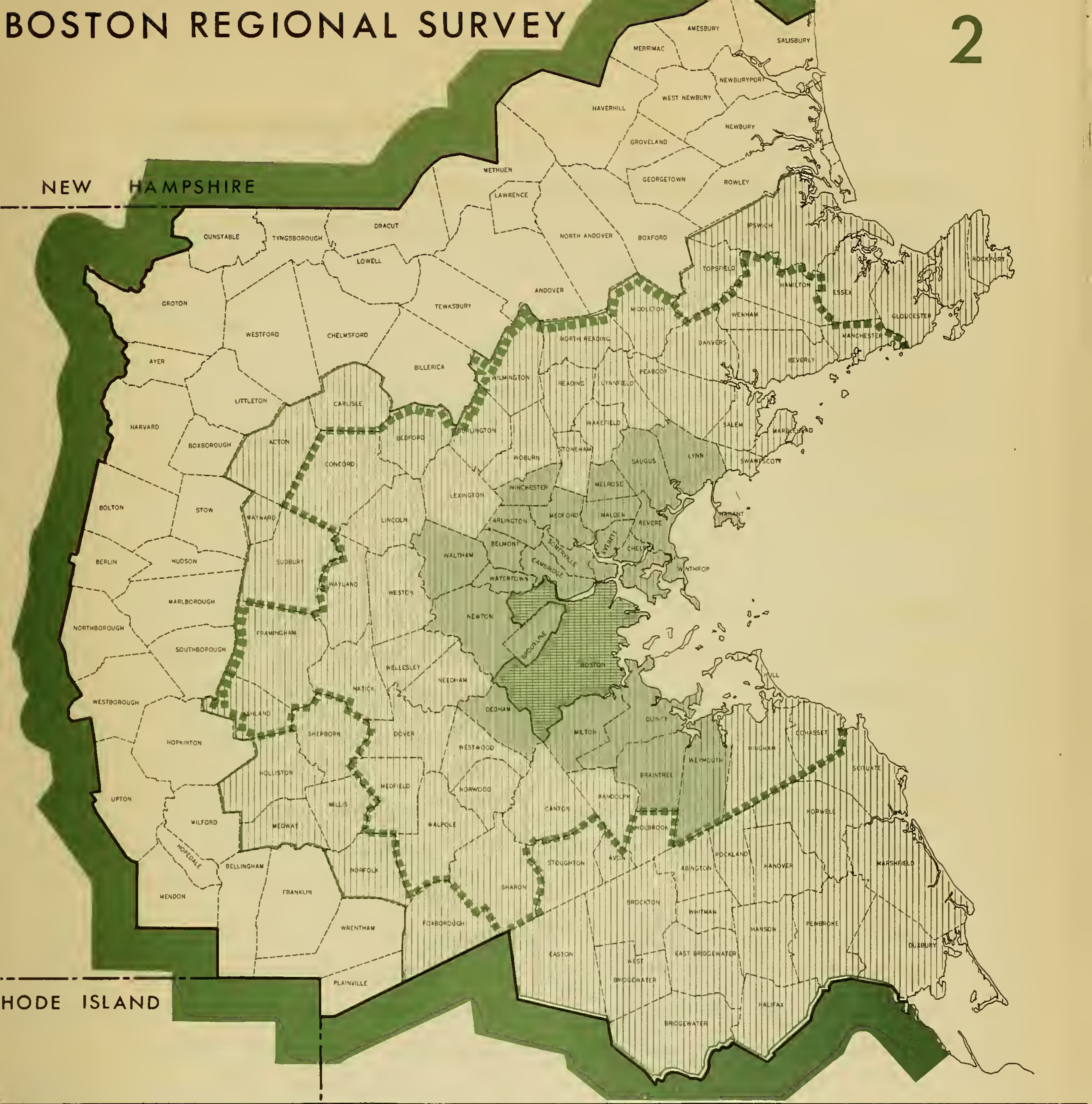

STUDY AREAS OF MAJOR HIGHWAYS REPORTS

- ▦ 1930 WHITTEN REPORT
- ▒ 1948 MASTER HIGHWAY PLAN
- ▥ 1958 B.C. SEMINAR STUDY
- ▪▪▪▪▪▪ 1962 INNER BELT STUDY
- ■ BOSTON REGIONAL SURVEY

GENERAL INFORMATION

- ☐ EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- ☐ MAJOR HIGHWAYS
- ☐ SECONDARY HIGHWAYS
- ☐ MAJOR RAILROADS
- ☐ SECONDARY RAILROADS
- ☐ RAPID TRANSIT LINES

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NORTH

1
2560 ACRES
SQUARE MILES

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REGIONAL HIGHWAY STUDIES

The region's major highway studies have consistently used the most up-to-date methods of traffic analysis. In particular, the 1930 Whitten Report is considered to be a milestone in traffic studies throughout the nation.

In addition to the metropolitan surveys, other important traffic studies within the Boston region have been prepared. A Master Highway Plan for the Lowell-Lawrence-Haverhill Area, prepared in 1956 by the State Department of Public Works, has formed the basis for highway improvements in the Merrimac Valley that are now either completed or in various stages of construction or design. In 1954 the Boston Traffic Commission conducted a cordon count around the downtown area. This study was designed for inventory purposes only, to be used in comparison with earlier cordon counts made in 1927, 1932, 1938 and 1950, and did not include any analysis or recommendations. Other studies of specific problems have been made throughout the region dealing with local problems and specific projects. These include various expressway traffic analyses, socio-economic and highway impact studies, and traffic circulation and parking studies for individual communities. (See Bibliography, Boston Regional Survey.)

In order to trace the development of the regional highway system and to gain an insight into the various factors shaping this system, five major studies are reviewed below. The review of each report is divided into four subsections: general aspects, traffic analysis and forecast, major proposals and summary.

Report on a Thoroughfare Plan for Boston, 1930 (Whitten report)

General

The technique of traffic analysis and the organization and methods used in the preparation of this report characterize it as a significant step in the development of metropolitan area transportation studies. Traffic assignment methods used to estimate traffic volumes on proposed facilities are valid even today and many recent traffic studies throughout the country show a marked similarity to this traffic analysis method. The Whitten report was one of the first studies to use travel time analysis as a measure of highway service. In this connection, it is noteworthy that the 30 minute travel time isochrone from downtown Boston has not changed appreciably over the past 30 years.

This report assumed a major reliance upon public transportation for peak travel hours. Continued public acceptance of the mass transit system was the basis for the report's recommendation that the rapid transit system be extended outward to reduce Boston's rush-hour street traffic. The report also assumed that an expansion of street and highway capacity to accommodate rising off-peak traffic volumes would not necessarily result in further traffic volume increases which would again congest the system. In this respect the report was unrealistic. For example, the recently completed Southeast Expressway, Central Artery and Storrow Drive were filled to capacity shortly after being opened. Each of these new traffic facilities has experienced peak-hour congestion since they were opened to traffic. At this time it is not possible to assess the impact that rapid transit extensions might have on these traffic facilities during peak hours.

Traffic Analysis and Forecast

A comprehensive origin-destination survey in the area using 178 roadside interviewing stations was the basis for the projections and recommendations. A total of 188,000 interviews were conducted over half the city of Boston along with surveys of traffic volumes and travel time.

Statistical analysis to expand the 1927 traffic data to future years was based exclusively on projected population growth and the trend in the persons-per-vehicle ratio for study sub-areas. The report projected traffic data for a 35-year period extending to 1965.

The Whitten report's forecasts of population and vehicle registration for 1965 were high. The population projection for the 39 cities and towns in Metropolitan Boston was over estimated by 33 per cent; motor vehicle registrations were only 8 per cent above actual 1960 figures. The more accurate vehicle registration figure resulted from an assumed persons-per-vehicle ratio of 4.22 which proved to be high, however, this error was compensated for by the population projection.

The persons-per-vehicle ratio was expected to level off to a minimum of 4.22 persons-per-vehicle after 1945. Actually the 1960 estimated persons-per-vehicle ration was 3.43 for the study area. It is ironic that 1945 was to mark the beginning of an increase in automobile registrations so tremendous that even projections made at the time in the 1948 Master Highway Plan fell short of actuality.

The 35-year forecast period of the Whitten report was unusual in terms of its length. Many recent traffic reports have used 20 years as a target date to test the feasibility of constructing new facilities and some have used time periods as short as 15 years. The report's major proposals, however, were based upon the area's short term needs.

In addition to the fact that this report proved high in its long-term projections of population and automobile registrations, the report failed to take into consideration future changes in the land use or population and economic composition of the metropolitan area. However, despite these shortcomings in forecasting technique and projections, the analysis of the basic origin-destination data was excellent and provided the necessary background to develop a valid arterial system to serve existing and future traffic volumes.

Major Proposals

Many of the proposed traffic improvements in this report have been built and have become key facilities in the region's current traffic system. Although some of the proposals were not carried out until recently, they were built in much the same manner and location as recommended in this report. Figure 3 shows the major recommendations of the Whitten report and points out their relationship to the existing highway system.

One primary recommendation of the report which showed great foresight was the construction of a four-lane tunnel to East Boston. Construction of the Sumner Tunnel had been authorized by the legislature and accepted by the city of Boston while the study was in progress. The Whitten report pointed out that the $16 million authorization was not sufficient to build a four-lane facility, and that additional money should have been allocated for this purpose. The report estimated that the two-lane tunnel would reach capacity volume in 1934, soon after its opening. For this reason construction of an additional two-lane tunnel was recommended.

Interestingly, the report erred in its estimate of the future source of tunnel traffic. Expanded industrial development was suggested as a major future generator of tunnel traffic, while traffic to the airport in East Boston was not considered.

BOSTON REGIONAL SURVEY

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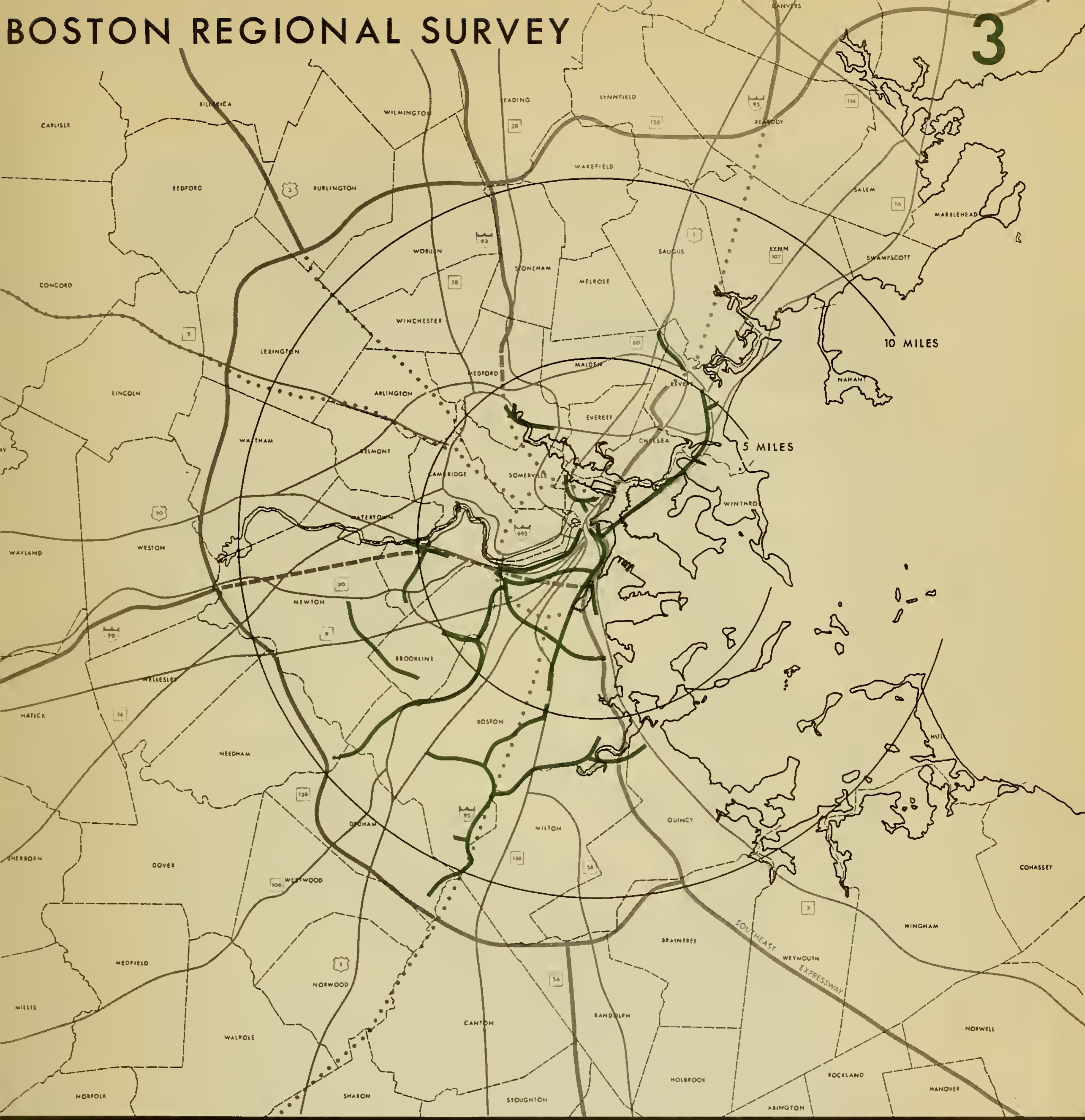

THE 1930 THOROUGHFARE PLAN

PROPOSED MAIN ARTERIES

SOURCE: WHITTEN REPORT

GENERAL INFORMATION

EXPRESSWAYS
UNDER CONSTRUCTION
PROPOSED
MAJOR HIGHWAYS
SECONDARY HIGHWAYS
MAJOR RAILROADS
SECONDARY RAILROADS
RAPID TRANSIT LINES

NORTH

1 SQUARE MILES

0 1 2 3 4 5
MILES

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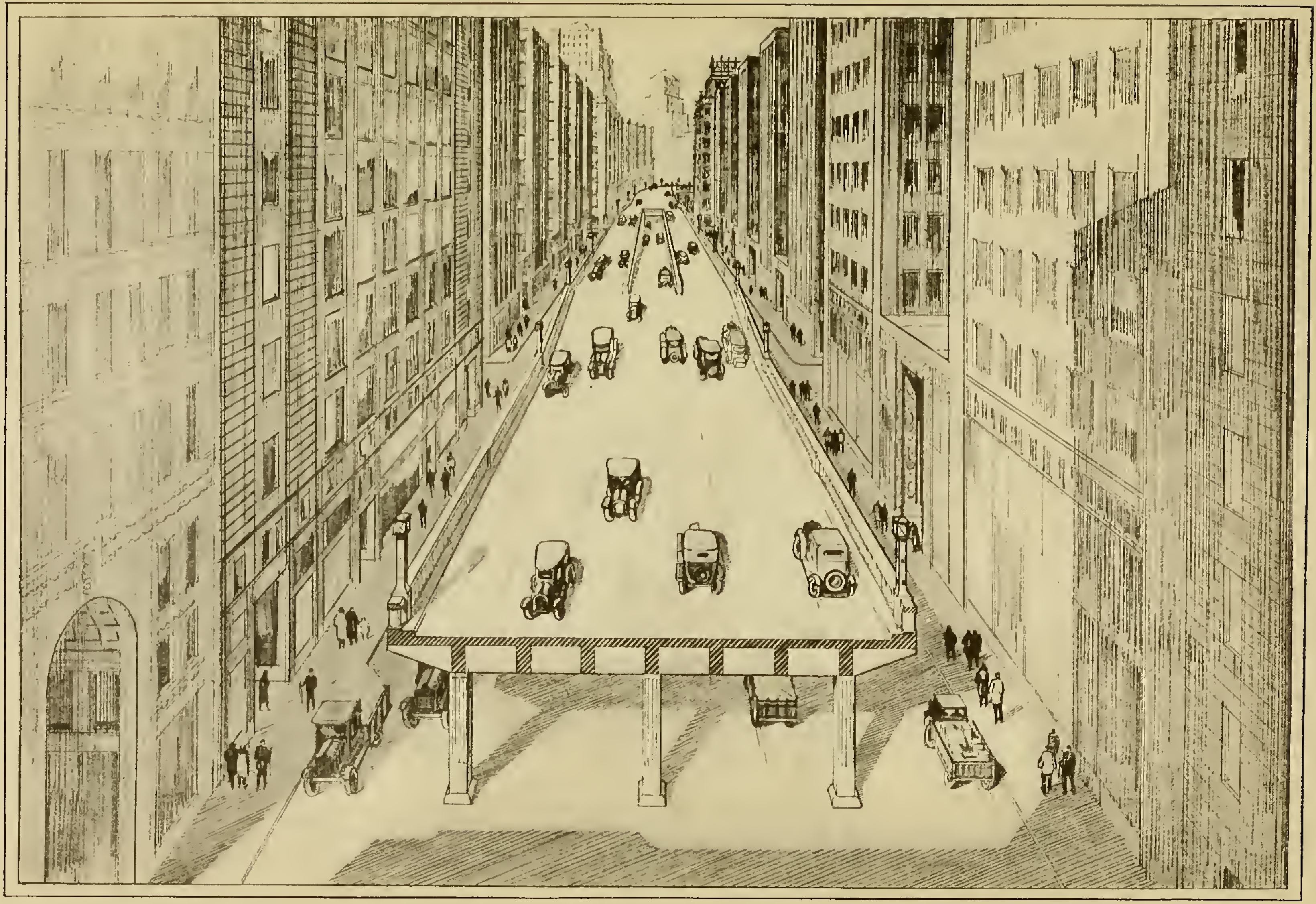

PROPOSED CROSS SECTION OF CENTRAL ARTERY, 1930

SOURCE: WHITTEN REPORT

4

A Central Artery was proposed for very much the same location as it was finally built to serve traffic in the manner originally conceived. The Central Artery was recommended as a two-level facility with the upper roadway for express travel and the surface roadway serving as a local access and feeder street. Figure 4 shows a cross section of the proposed Artery taken from the Whitten report. It is remarkably similar to other facilities which have been designed in recent years in Boston and other cities, again emphasizing the advanced traffic and engineering concepts displayed throughout the report.

Of special interest was a proposed Roxbury cross-town highway to connect the arterial routes in the southeast and southwest sector and to provide a facility for cross-town movement indicated by the origin-destination study. While the principle of a belt route was not defined nor explicitly recommended, this proposed facility would have performed such a function. The proposed location of the cross-town route is similar to the location of the highway proposed in recent Inner Belt study.

Summary

Although highway usage has far exceeded the projections of the Whitten report, many of its recommendations are valid today. The report's main deficiencies arise from the fact that the criteria recommended for highway improvements were not adequately related to future travel desires, particularly the needs of a suburban-oriented population. In addition, proposals for improvements within the downtown area of Boston were based on vehicle traffic, and omitted consideration of transit riders. As a result, the 1927 study of origin and destination provided an excellent analysis of the demands of vehicles, but gave too little attention to the requirements and future role of rapid transit.

REGIONAL HIGHWAY STUDIES

The Whitten report based its recommended highway improvements on the assumptions that (1) highways were needed to accommodate all traffic that could not conveniently or economically use railroads or rapid transit lines, and therefore, (2) a good highway system was necessary for the economy of the region.

There was an explicit assumption that the highway system and the rail rapid transit system would not compete with one another and that the automobile would not impinge on the function performed by rapid transit. It is not clear whether this assumption was included in the report to appease proponents of mass transportation or whether it was believed to be a realistic prognosis despite the fact that several of the major projects proposed in the report were radial routes paralleling existing transit and railroad lines.

Although the report was correct in its judgement that the recommended expressway and parkway system would be of immense benefit to the city of Boston, it failed to recognize that the recommended highway system would help to undermine the stability of the public transit system. Furthermore, the Whitten study contained an erroneous assumption, repeated until recently in subsequent reports, that long-term relief for traffic congestion could be achieved by providing additional highway facilities.

The Master Highway Plan of 1948

General

This report, sponsored by a joint board consisting of the State Department of Public Works, the State Planning Board and the Metropolitan District Commission, incorporated the most extensive field study made to date in the Boston area and is the primary basis for the expressway system within Route 128. This study was prepared before funds for

highway improvements became available in an unprecedented amount through the Federal Highway Act of 1956 (the Interstate Program). When the need for an expressway system became acute and when federal funds became available for construction, the Boston area was prepared with a sound plan for extensive highway construction.

The field study for the survey was carried on during the autumn of 1945, immediately after the end of the war. Conducted shortly after the gasoline rationing was terminated, the survey found that mass transportation trips outnumbered trips by private automobile. There were 979,000 mass transportation trips in the study area as compared to only 812,000 vehicle trips. The shortage of gasoline and tires as well as the cessation of private automobile production during the war accounted for this transitory pattern. The 1948 Master Plan, like other plans based on surveys made immediately after the war, tends to be seriously distorted in the direction of overestimating public transportation volumes and underestimating private vehicle use.

Traffic Analysis and Forecast

Data for the traffic survey was obtained from two sources: home interviews within a cordon line roughly at the location of Route 128, and driver interviews for vehicles entering the metropolitan area at the cordon line. A five per cent sample was used for the home interviews resulting in a total of 22,500 interviews. A ten per cent sample of trucks and taxis was also taken. At the cordon line nearly 60 per cent of all vehicles (approximately 111,000) crossing into the study area were stopped and their drivers interviewed.

This was the first time the home interview method of obtaining origin-destination data was used in the Boston area. The techniques used

in this report were standard for the period. Mass transportation trip information was obtained from the home interviews. Since no mass transportation data was secured from persons crossing the cordon line no information was obtained on railroad commuters entering from outside the cordon. These long-distance trips probably would not have had major significance for the highway plan since this study preceded the era of large scale suburbanization, but for purposes of preparing for an overall transportation plan (including disposition of railroad commuter lines) such information is vital.

Specific attention was given to downtown area traffic. It was found that the heaviest movement into the downtown area came from the west and the lightest movement from the north. The study found that 25.5 per cent of all traffic movement within the cordon (Route 128) occurred within the downtown area. Only a sixth of the total traffic entering the downtown area could have by-passed the Central Business District.

The report estimated that between 1945 and 1970 traffic in the study area would increase by 77 per cent in stable core areas and 135 per cent in fast growing suburban sub-areas. However, within five years it became clear that these projections grossly underestimated actual increases in automobile usage.

The 1945 to 1970 traffic projection was based on a combination of population increase, vehicular ownership, and an increase in vehicular usage. The study projections proved to be low with respect to population and ownership but high with respect to the projected increase in vehicular usage. The sharp rise in annual mileage from 7,771 miles per vehicle

in 1945 to 9,947 in 1946 was not repeated; in fact annual mileage has not reached the 1946 level in the past sixteen years.[1] Although the report took into consideration such items as shifts in population and changes in the person -per-vehicle ratio, the extent of these changes was underestimated.

Major Proposals and Recommendations

The Master Highway Plan proposed a system of arterial expressways joined at the hub by an inner belt route. Another belt route (Route 128) was proposed for construction along the perimeter of the built-up portion of the metropolitan area. Figure 5 shows the major recommendations of this report. The names given to individual expressway routes in this report have, for the most part, been retained and thus are easy to identify.

The report states that four of the proposed expressways would be included in the network of interstate highways proposed in a report to the President in 1944. This study by the National Interregional Highway Committeee formed the basis of the Interstate System adopted in 1956. These new highways were proposed along Route 1 north and south, and along Route 20 and Route 3. Only the first two routes later became part of the interstate system (Interstate 95). Of the two routes that were not to become part of the interstate system, one would be built as a toll facility (the Massachusetts Turnpike) and would be the first of these routes to reach into the downtown area and the other, Route 3, would be one of the first major radial expressways to reach as far inward as Route 128. Other radial and belt routes proposed in this report have either been built or are still proposed in the most recent plans of the DPW.

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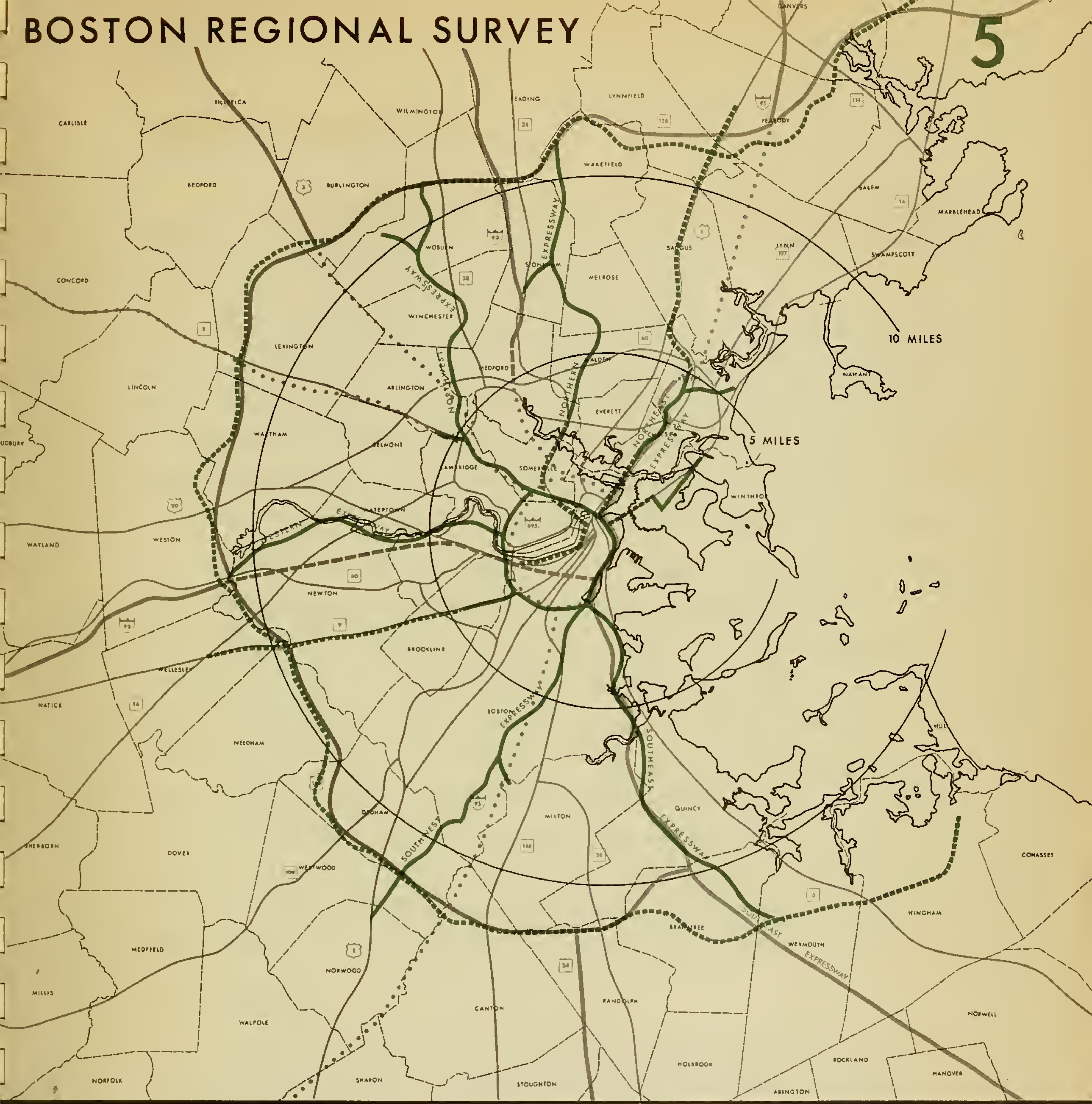
[1] Facts and Figures (Automobile Manufacturers Association, Detroit, 1961)



THE 1948 MASTER HIGHWAY PLAN

—— PROPOSED EXPRESSWAYS

•••••••• PROPOSED ADJUNCTS TO EXPRESSWAYS

SOURCE: 1948 MASTER HIGHWAY PLAN

GENERAL INFORMATION

- EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES

0 1 2 3 4 5
MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

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BY THE PLANNING SERVICES GROUP, CONSULTANTS

In addition to the expressways proposed, a number of street improvements were suggested for the downtown area and sixty-one improvements to existing streets and highways were recommended.

Generalized parking recommendations in the report suggested that Boston and other cities prepare long-range parking plans. The report cited a study by the Boston Planning Board to guide the expenditure of $5 million for parking sites and structures. (Some years later, however, construction of a single major facility, the Boston Common Garage, cost almost $10 million not including any expenditures for land-taking.)

In the tradition of highway studies the Master Highway Plan contained a section on public transportation entitled "Coordination With Transit Improvements." Among the items touched upon was the possible use of express buses on the expressways system, particularly over the Mystic River Bridge and the Southeast Expressway. All intercity buses were expected to use the Central Artery. Several bus terminals were planned for the downtown area. The report suggested use of consolidated rights-of-way for both highway and rail facilities, although it made no specific recommendation. Although none of these recommendations were adopted, there has been considerable recent interest in permitting bus service on expressways and in providing joint rights-of-way for highway and rail facilities.

Summary

The Master Highway Plan of 1948 forms the basis for the Boston area expressway system. Prepared immediately before a tremendous increase in vehicle registration and usage, the plan became the official program for meeting the vehicular problems of the region. Implementation was greatly assisted by the enactment of the Interstate Highway Program that was to give tremendous nationwide impetus to expressway construction.

Unfortunately, this report, like the Whitten Report failed to foresee the approaching decline in mass transportation patronage. Part of the reason for the low traffic projections contained in this report is that only vehicular trips were used as a base for the traffic projections and no consideration was given to increased vehicular use due to a shift in mode of transportation. The report took for granted eventual construction of the transit extensions recommended in the Coolidge Commission Report of 1947. It was stated explicitly that the recommended expressway system would be inadequate to handle future traffic volumes unless these transit improvements were made.

Future transportation reports are likely to alter or revise rather than supersede the 1948 Master Highway Plan. Progress in implementing the Plan has thoroughly committed the area to the basic concept of expressways as proposed in the 1948 report.

Report On Traffic Study For the Boston Metropolitan Area, 1957

General

This report consists of three separate sections: Section A deals with the extension of the Massachusetts Turnpike into Boston; Section B is essentially a review of the Master Highway Plan of 1948; and Section C analyzes the feasibility of providing an additional harbor crossing and its impact on the expressway system. Section C which is primarily concerned with specific facilities has not been widely distributed and is not considered to be regional in scope.

In general, the entire report has not received the wide attention of the major traffic studies of 1930 and 1948, partly because it did not receive wide distribution, and also because it made no new major transportation proposals. For these reasons the report has not materially affected regional highway plans.

Traffic Analysis and Forecast

The major field effort in this study was an origin-destination survey using stations along Route 128 to form a cordon around the metropolitan area. Many stations were in the same location as those for the 1948 study, making it easy to up-date some of the earlier data. The origin-destination data was gathered by driver interviews, a technique similar to that of earlier reports. No information was obtained for trips with origins and destinations within the cordon area.

While trips passing through the cordon could be updated easily, the problem of updating internal trips within the Route 128 cordon was more difficult. Trips within the cordon were projected on the basis of the expanded volume through the cordon line, Route 128. Between the 1945 and 1955 surveys, however, the suburban explosion had taken place. Consequently the number of trips crossing Route 128 increased at a much greater rate during the ten year period than had trips between places within the cordon line. The net result of expanding internal trips on the basis of changes in cordon line crossing was an overestimation of the number of internal trips.

The report anticipated that during the 20 year period, 1955-1975 the normal traffic growth of the metropolitan area would be about 81 per cent or about three per cent per year on the average. It was expected that new high speed facilities would generate a demand over and above normal traffic growth. This factor was estimated to be 45 per cent of the traffic expected to use the expressways. Between 1955 and 1975 traffic on the expressway system alone was expected to increase by 160 per cent.

Particular attention was given to the effect of construction of the Southwest Expressway on the highway system. In instances where facilities were in competition with or were likely to receive traffic from the Southwest Expressway, assignments were made with and without

construction of this expressway.

This report assigned traffic to the various expressways without regard to the anticipated capacity of the proposed facilities with the result that in some traffic corridors the 1975 estimated traffic volumes were clearly beyond highway capacity. For example, a section of the Southeast Expressway near the Inner Belt showed a 1975 assignment of 370,000 vehicles per average day, about three times its potential capacity.

Major Proposals and Recommendations

In general the Report on Traffic Study for the Boston Metropolitan Area lent further support to the Master Highway Plan of 1948 with regard to the need for and location of the various expressways. However, it pointed out that the traffic estimates for 1970, on which the Master Highway Plan of 1948 was based, had already been exceeded by 1957. While the study recognized the unanticipated and unprecedented growth of traffic following the 1945 study, it did not offer any solution to the problem of demand other than to suggest that excess volumes would have to be absorbed by the arterial street system.

There was one new element in this report, namely the recommendation for a Massachusetts Turnpike extension to connect with the Central Artery near the South Station. In contrast, the 1948 plan had recommended construction of a western expressway which was to terminate at the Inner Belt.

This report was the first to assign traffic to the Sumner Tunnel, with the result that the need for a second tube was made clear. Moreover, it estimated that by 1972 another harbor crossing in addition to the two-lane Sumner and Callahan Tunnels and the Mystic River Bridge would be needed. (The Mystic River Bridge was under construction while the 1948 study was

being prepared. At that time it was generally felt that four lanes of tunnel capacity plus the bridge would be adequate for 1970 traffic.)

Summary

The Report on Traffic Study for the Boston Metropolitan Area, 1957 has not been the basis for the construction of major traffic facilities. However, it did provide a review and updating of the Master Highway Plan of 1948. The value of the report was limited by its failure to consider the public transportation system, particularly the future of rapid transit. This omission is surprising in view of the large amounts of traffic that the study assigned to certain traffic corridors in the Central Business District and to the sharp drop in mass transit ridership which had occurred by 1957.

Travel in the Boston Region, 1959-1980

General

Prepared by the Boston College Seminar Research Bureau in 1958 this report is unique in certain respects. It is the only study of the five discussed in this chapter that was not prepared by a government agency. It is the first study in the region that has not been based on a large amount of field-collected statistical data, but relied instead on the gravity model technique of travel analysis. This technique involves use of complicated formulae based upon previously determined relationships between land use, economics and transportation. This was also the first of the region's traffic studies to analyze traffic patterns outside Route 128; the boundary of the study area extended in an arc generally one tier of communities inside the Outer Belt.

In addition, the Boston College report recognized the concept of

studying total trips generated and assigned these trips to various modes. Previous studies assigned traffic to the highway system and did not consider mass transit trips. Furthermore, previous studies did not consider changes in trip patterns which might result from changes in land use.

Traffic Analysis and Forecast

The information for the study was based on a 0.12 per cent sample; 1,000 out of 825,000 families in the study area were interviewed. Four factors were used as the basis for predicting future travel requirements: (1) 1959 and 1980 population and its distribution, (2) estimated size and distribution of employment, (3) car ownership characteristcs, and (4) measures of travel time. These factors were used as inputs to develop the gravity model equations.

The report forecast a minimum of 650,000 person-trips for downtown Boston by 1980. It was stated that the modal split in 1980 will be similar to 1959: 37 per cent of persons entering the CBD will use mass transit and 63 per cent will use automobiles. The report estimated that an additional 10,000 off-street parking spaces over and above those existing in 1959 will be needed in 1980 to accommodate short-term parkers in the downtown area.

Major Highway Proposals

The study supported the findings of the Master Highway Plan of 1948 but recommended some additional improvements. Top priority was recommended for the Inner Belt. New suggestions included the construction of Route 2 as an expressway and construction of an Intermediate Belt. The report rejected construction of expressway elements within the Inner Belt as suggested in prior studies.

The highway recommendation for which the report is perhaps best known is that an Intermediate Belt route be constructed in an arc with a radius of about five miles from the center of Boston. The study suggested that this route would relieve congestion on Route 128 and the Inner Belt. However, no specific route was recommended since the study was not designed to make recommendations for the location of routes or interchanges but was limited to study major travel desire corridors.

Summary

The fact that this report was undertaken independently by a university and that the gravity model technique was used make the study unusual for the Boston area. In addition, it is the first regional study to consider seriously both highway and rapid transit needs and to study them as part of an overall transportation system.

However, because of the very limited sample taken for the study, and the fact that the gravity model approach is still in the experimental stage, the study does not provide a strong foundation for proceeding with specific capital improvements. Therefore, while general findings and overall estimates of travel requirements may be valid, it would be imprudent to commit major outlays of highway or transit construction funds solely on the basis of the research findings and recommendations contained in the Boston College Study.

Inner Belt and Expressway System, 1962

General

This report, published in the summer of 1962, was concerned primarily with the segments of the region's highway system within Route 128 that had been recommended in earlier reports and have been listed for some

time as being in the proposed stage. A total of 65 communities were included in this traffic study area and 121 in the socio-economic study area (see Figure 2). Segments of the expressway system studied in great detail include Interstate Route 93,(the Northern Expressway)between Medford and the Inner Belt, Route 3 Expressway, the Northwest Expressway,(Route 2) Interstate Route 95 south,(the Southwest Expressway)and finally, and perhaps most important, Interstate Route 695, the Inner Belt, which would provide a terminal and distributor for the radial expressways.

This is the first major State Department of Public Works traffic study to rely on the model technique for the assignment of traffic to the expressway system. Also it is the first study to use an extensive socio-economic analysis in a traffic report; the data from such an analysis is essential to the mathematical model technique used in the report.

One of the most significant aspects of this report is the extreme detail in which the various routes were studied. These details for each recommended and alternate location were grouped into two general categories, (1) physical effects and (2) project costs. Physical effects included the number and use of structures that would be affected, and displacement of householders and employees. These items were studied by individual cities and towns. Project costs included acquisition of right of way at fair market values. A separate road-user benefit analysis was also made for each section of the expressway system.

The report has aroused wide interest in the Boston area for two reasons. (1) The construction of the recommended expressways would involve traversing the most densely populated portions of the region and would create substantial dislocation. (2) Construction of the projects recommended will require an expenditure of $325 million over a proposed 10-year construction period.

Traffic Analysis and Forecast

The gravity model technique for traffic analysis was chosen after an exhaustive review of available data from previous reports revealed that the information that had been collected earlier could not be used effectively in an empirical traffic projection and analysis. Furthermore, since socio-economic and land use information would be needed in the analysis of the various routes, this same information could be utilized as the input for the gravity model.

The gravity model is a mathematical evaluation of a variety of social, economic, land use and traffic factors based upon known relationships that have been developed in other locations and have been proven reliable over a number of years. The term "gravity" refers to the fact that these models are based on relationships that resemble the physical law of gravity. (Bodies exert a force on each other proportional to their mass and inversely proportional as the square of the distance between them.) The attraction between typical centers of population and the attraction of retail and industrial centers have been measured and can be mathematically reproduced.

Another major advance in recent years has been the study of the diversion effects of expressways with resultant data expressed in the form of diversion curves. These curves, usually plotted on graphs using time and distance coordinates, show the relationship between time and distance when alternate routes between two points are available. In this report information of the minimum time distance routes were used as input for the model and as the basis of assigning traffic to the expressway system.

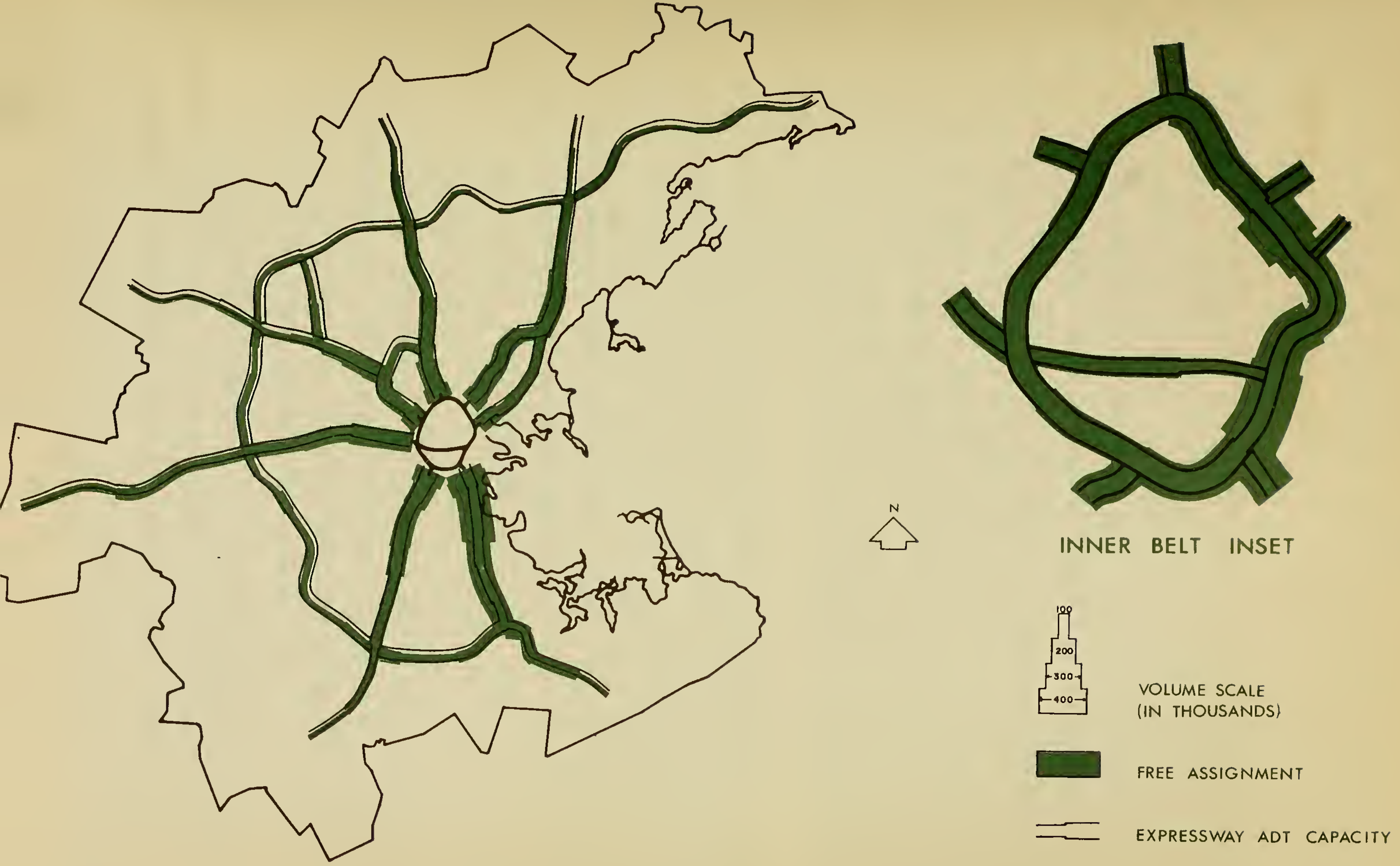
This report deals extensively with the development of the gravity model. It analyzes earlier developments in model-making and reviews recent efforts throughout the country. A portion of the report deals with the mathematical development of the model as well as the derivation of input data.

As a first step, the Inner Belt report assigned 1975 traffic to the expressway system on a free assignment basis without regard to expressway capacity. It was found that on this basis all segments of the expressway system would be overloaded beyond their capacity by 1975. Some sections of the system showed assigned traffic volumes three to four times their capacity. Figure 6 shows the 1975 free assignment volumes computed in the Inner Belt report. Traffic volumes of about 500,000 vehicles per day were predicted by 1975 for a section of the Inner Belt with a capacity of about 150,000 vehicles per day. The most heavily loaded radial facility would be the Southeast Expressway, where the volume south of the Inner Belt is estimated to exceed 300,000 vehicles per day. Route 128 is the only highway which was projected to show an excess of capacity in 1975 because of its recent widening and also because construction of the Inner Belt was assumed as completed. If the Inner Belt were not completed, the 1975 volumes on Route 128 would probably rise beyond its capacity.

After a free assignment was made in the initial stage, the study made new assignments of traffic so that capacity of the expressways would not be exceeded. It was implied that excess traffic capacity would be handled by arterial streets. The capacity-adjusted traffic assignment was designed to provide information for the design of interchanges.

Major Proposals and Recommendations

The purpose of this report was the preparation of location studies and recommendation of basic design for the sections of the expressway system which remain unbuilt. The primary recommendation was that the expressway system for the Boston area should be completed as soon as possible to take full advantage of the road-user benefits that would accrue to the motorists using the expressways. In addition, the report predicted significant socio-economic gains as a result of completion of the expressway



1975 FREE ASSIGNMENT VOLUMES

SOURCE: INNER BELT AND EXPRESSWAY SYSTEM, 1962 (MASS D.P.W.)

6

system. These would take place in the form of new industrial development, strengthening of urban centers, particularly that of downtown Boston, and in more efficient use of land. In addition, the study suggested that coordination with several urban renewal projects would yield benefits both to the communities involved in renewal and to the DPW in constructing these expressways. These benefits were to be derived from integrated planning in these project areas as well as from financial benefits from state expenditures. The report indicated that families and businesses displaced due to expressway construction would benefit significantly from an organized approach to this problem by urban renewal agencies. Under the urban renewal program there is direct aid to displaced businesses and families in the form of relocation expenses and services.

A four-stage program of construction is proposed in this report, with the entire program to be under construction by 1969. Stage One projects include completion of I-93 to the Inner Belt, construction of the Inner Belt between I-93 and the Central Artery, and completion of a section in Boston between Brookline Avenue and the Charles River. The full Inner Belt would not be completed until the final stage since there would be portions built during each proposed construction phase.

Summary

The Inner Belt Report, deals with a subject of great concern to the Boston region, and particularly to the Core. The study represents a detailed analysis of portions of the basic expressway system previously established in the Master Highway Plan of 1948.

This report's strength lies in its careful analysis of the location of the unbuilt portions of the system. Each route and the alternates were investigated with an unprecedented amount of detail, including socio-economic effects as well as the more conventional physical aspects of highway construction. Unfortunately, while the report recognized the need for a coordinated

mass transportation and expressway system, a study of mass transportation needs and methods of coordination with highways was beyond its scope.

Summary

This review of the major regional highway studies which have been conducted over the past 35 years points to certain research deficiencies. The lack of up-to-date travel information in the Boston region has been a serious handicap to planning. The 1948 Master Highway Plan was based on information collected specifically for that purpose. However, of the three major highway plans prepared since that time, only one involved the collection of additional data to update the 1948 information, and two reports have relied on the gravity model technique to develop traffic assignments for an expressway system. While each of these studies has had some value, traffic plans are still based on the traffic data collected nearly twenty years ago in a very different environment. Furthermore, the data collected for the 1948 study was collected in 1945 during a period when travel was not representative of normal conditions.

An equally important deficiency is the lack of coordination in planning highway and rapid transit improvements. Each of the five major reports reviewed here mentions the need to maintain public transportation and to coordinate it with other modes of transportation. However, only one report, the B.C. Seminar study, attempted to coordinate improvements to highways and mass transit facilities. No study in the region indicated clearly the manner in which highway and transit facilities can be coordinated, the effect of the construction of either type of facility upon the other, nor the comparative advantages and disadvantages of alternative transportation mixes to the users and residents of the region.

Another deficiency is the lack of understanding of the impact that construction of highway or transit facilities has upon individual communities and the region as a whole. No consideration to the cost and benefits of either a highway system, a transit system, or various combinations of both have taken into consideration the net effect upon the region's economy.

The review of highway planning studies shows many innovations and advances in the techniques and art of traffic assignments and highway design. The quality of the reports reviewed compare favorably with those produced for other cities in the nation and the Boston region can take pride in its highway planning activities. In the future, however, studies of transportation in the Boston region must accumulate new data, realistically coordinate highway and transit improvements, and analyze the effect of these improvements and their alternatives.

3. THE ROAD-BUILDING AGENCIES AND MAJOR TRAFFIC FACILITIES

General

Within the Boston region five public agencies build or operate automobile traffic facilities: (1) the State Department of Public Works, (2) the Massachusetts Turnpike Authority, (3) the Metropolitan District Commission, (4) the Massachusetts Port Authority, and (5) individual communities. This chapter reviews the organization of the agencies, their responsibilities, major projects, and the mileage of roadway for which they are responsible in the Boston region.

The State Department of Public Works is the most important of these agencies. It is responsible for all construction financed by the state and is the only official state agency through which federal highway funds can be channeled. The DPW, although responsible for the entire state highway system, focuses much of its attention on the Boston region where a majority of the state's highway construction funds are spent.

The Massachusetts Turnpike Authority is responsible for three facilities in the region: (1) the Massachusetts Turnpike, 26 miles of which is within the region; (2) the 12 mile Boston extension of the Turnpike; and (3) the Sumner and Callahan Tunnels. The Turnpike Authority ranks second in amount of money expended on highways in the region.

The Metropolitan District Commission Parks Department over a period of years has been assigned some of the most critical traffic facilities within the region. Storrow Drive and Morrissey Boulevard, for example, are under the jurisdiction of the MDC.

The Massachusetts Port Authority has jurisdiction over only one major traffic facility, the Mystic River Bridge. This bridge was built by a special Mystic River Bridge Authority which was dissolved when control of this facility was given to the Port Authority in 1959.

Finally, there are the individual communities which have primary responsibilities for local improvements on the roadways that comprise 90 per cent of the mileage of the region's highway and street system. Most of this mileage is in local residential streets and is not part of the regional arterial system. The larger part of local road-building funds are used to match state funds under the Chapter 90 Highway Program. In many communities Chapter 90 matching funds are frequently the only set expenditures for highway improvements, although additional funds are incorporated in annual appropriations to local public works departments.

The Department of Public Works

The State Department of Public Works, established over sixty years ago, is responsible for most of the highways within the Boston region. The entire expressway system, except for the Massachusetts Turnpike, falls under the jurisdiction of the DPW. Organized as a commission in 1892, the Department of Public Works was established in its present form by general acts of the 1919 State Legislature. The department is responsible for all state highways and maintains its headquarters in downtown Boston. In addition to the headquarters offices, the state is divided into engineering districts supervised by District Engineers, with headquarters at district offices. Department activities in the district parallel those in the headquarters although the emphasis at district offices is on maintenace work and Chapter 90 assistance. Within the region there are district offices in Arlington, Boston, and Danvers.

Work required on major projects is usually carried out through the Boston headquarters. In addition to a Chief Engineer and an Associate Chief Engineer, the department has several divisions which are closely connected with the planning and construction of highway improvements. Major divisions include Traffic, Highway Design, and Locations and Survey.

As of July 1, 1961, the DPW was responsible for almost 2,500 miles of state highway, of which 900 miles were within the Boston region. (There were approximately 24,000 miles of local roads within the State, of which 10,000 were located within the region.) In addition to the expressways it controls, the DPW is responsible for many primary and secondary highways. It is estimated that there are 372 miles of expressways in the region and an additional 523 miles of primary and secondary roads under DPW control. These primary and secondary roads range from major highways like Route 20 and Route 9 to relatively minor roads traversing the fringes of the region such as Route 40 and Route 109.

The allocation of state highway mileage among the state's communities is determined by the DPW. There is no rigid formula for this allocation. The federal government requires that the state maintain a system of primary and secondary highways, but does not require any particular geographical apportionment of federally-aided highways.[1] The heavily populated core communities clustered around Boston have only relatively limited amounts of route mileage in the state highway system. In contrast, in suburban areas some of the most sparsely populated communities have the largest amount of state highway mileage. This results from the fact that highways connecting major cities pass through mostly open country. One community may have virtually no state mileage while an adjacent town, traversed by intercity routes, may have as much as 15 or 20 miles within its borders. A community which is served by state highways receives several benefits. At no cost to the community, DPW improves and maintains these roads and provides snow plowing, salting and sanding operations during the winter months.

While the Department of Public Works maintains a logical system of primary, secondary and urban highways which form the state highway

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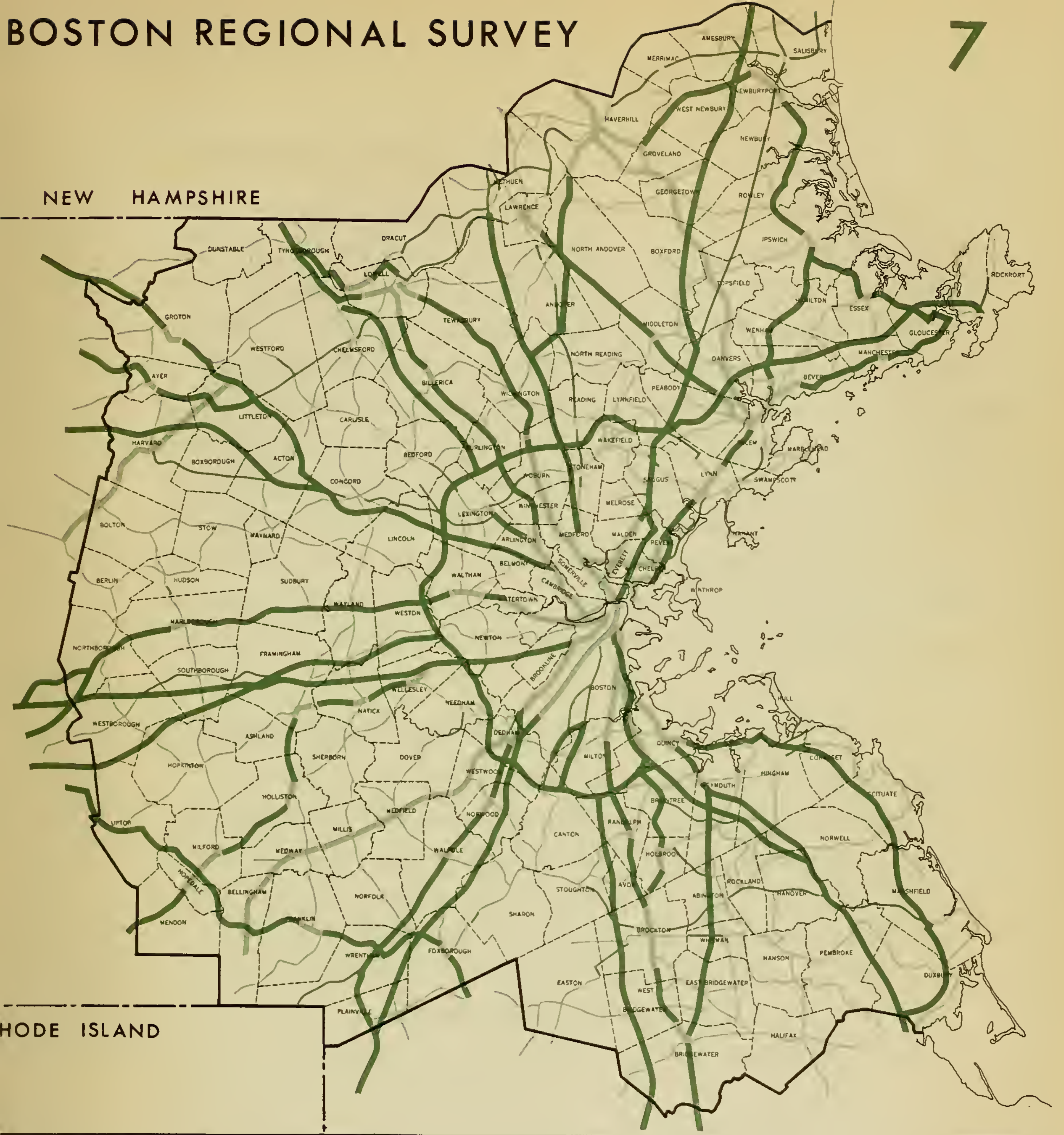
[1] Federal Laws Relating to Highways, (Washington: United States Government Printing Office, 1960).

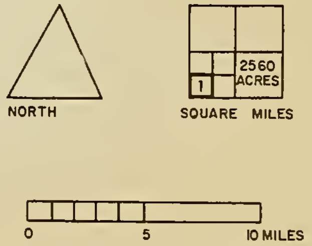
BOSTON REGIONAL SURVEY

7



FEDERAL AID HIGHWAY SYSTEM IN THE BOSTON REGION

- STATE HIGHWAY - PRIMARY SYSTEM
- STATE HIGHWAY - SECONDARY SYSTEM
- LOCAL ROAD - PRIMARY SYSTEM
- LOCAL ROAD - SECONDARY SYSTEM



EPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

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system, identification of this system is somewhat difficult, because: (1) contiguous sections of roadway may be under separate jurisdictions; (2) designation as federal primary numbered routes (those identified by a number in a shield) does not necessarily imply federal assistance; (3) some state numbered routes are not included within the federal-aid systems and are locally supported. The numbering system on the region's highways for both the federal primary and state numbered routes, is for guidance purposes only and does not indicate either the type or amount of financial aid received from the state or the federal government. From time to time the DPW issues a map of the state which shows the federal aid primary and secondary systems. The most recent map was issued in 1962 and the portion pertaining to the Boston region is shown in Figure 7.

The Massachusetts Turnpike Authority

Created by the State Legislature in 1952, the Turnpike Authority was empowered to construct a toll highway facility from a point in the Boston area to the New York state line.[1] The initial Turnpike, 123 miles in length between the New York state line and Route 128 in Weston, was financed through a $239 million bond issue in 1954. Construction was rapid; three years after the bonds were sold the entire road was open to traffic. Since the turnpike terminated at Route 128, core-bound vehicles were forced to transfer to the local highway system utilizing such routes as 2, 9, 16, 20 and 30.

The enabling legislation of 1952 was modified in 1955 to permit turnpike construction to a point within the city of Boston. (The original act provided for termination at a point "in the vicinity of Boston.") However, construction of the extension was delayed because sale of the $80 million bond issue required for the 12 mile extension did not take place until early 1962. A primary reason for the seven-year

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[1] Chapter 354 of the Acts of 1952, Massachusetts State Legislature.

delay was the enactment of Federal Highway Act of 1956 authorizing 90 per cent federal assistance of the Interstate System. Many expected that the availability of 90 per cent federal funds would doom toll roads. Eventually, when it became apparent that turnpikes could still be built and financed successfully, problems in location arose, particularly in Newton where the Turnpike Extension would cause extensive damages to existing land uses and properties. Later, when these problems were resolved and a prospectus for the bonds was issued, further difficulties in marketing were encountered, partly as a consequence of the depressed bond market in the 1961 business recession. Finally, a successful formula was found to interest investors and the bonds were sold early in 1962.

In addition to the Turnpike and Turnpike Extension, in 1959 the Authority issued $52.8 million in Tunnel Revenue Bonds to finance construction of a two-lane tunnel to parallel the existing Sumner Tunnel. Ownership of the Sumner Tunnel was transferred to the Turnpike Authority so that both tunnels could be operated as a single toll project. As soon as the Callahan Tunnel opened in late 1961, the Sumner Tunnel was closed for extensive modernization. By the middle of 1962 both tunnels were in full operation alleviating a traffic bottleneck which had existed for many years.

The Turnpike Extension

The Turnpike Extension will be built as a toll facility on the Interstate System, and will meet the rigid design standards established by the federal Bureau of Public Roads. The entire turnpike will eventually revert to toll-free public ownership and will probably then be transferred to the jurisdiction of the Department of Public Works. This may occur in the year 2002 when the bonds for the Extension reach maturity.

The Turnpike could be transferred to public ownership if toll revenues allowed repayment of the bonds prior to maturity date or if federal-state highway funds were appropriated for this purpose. The first condition would result from greater-than-anticipated use of the facility which would provide the additional toll revenues. The second condition would occur in the event of new federal highway legislation aimed at eliminating toll facilities from the Interstate System.

The Turnpike Extension will provide an extremely useful regional highway link since no western radial expressway now penetrates inside Route 128. The Extension will be located within a traffic corridor consisting of Routes 9, 16, 20 and 30, most of which are congested during peak hour periods, particularly those sections close to downtown Boston. Routes 9 and 16 pass through heavily developed areas and clusters of commercial and industrial development. Route 20 traverses the business districts of Waltham and Watertown and provides primarily local service. Route 20 is used heavily by trucks. In addition to these highway facilities the extension will follow and partially utilize Boston and Albany railroad branch lines and the Highland Branch of the MTA.

Studies show that the time now required to reach Route 128 in Weston, the present entrance to the turnpike, from downtown Boston is about 40 minutes. It is estimated that the same trip on the Extension will take between 20 and 25 minutes, depending on the time of day.

The Extension will be used by motorists already on the turnpike who wish to reach destinations in the core. It will be easy to reach the Extension from the other routes in the western traffic corridor, since Route 128 will act as a "yoke" between Routes 9 and 20, collecting inbound traffic from radial highways outside Route 128 and focusing it on the Turnpike Extension.

It is probable that even after completion of the Extension, traffic volumes on the western arterials will continue to be high. In 1959 the combined volumes of Routes 9, 16, and Route 30 just inside Route 128 was 94,000 vehicles per day and at Massachusetts Avenue traffic volume was nearly twice as great.[1] These roads traverse extensively developed residential commercial and industrial areas which generate large amounts of traffic. In addition, the infrequent interchange spacing on the Extension will not permit it to absorb short trips. Thus, the Extension may not appreciably reduce present volumes on parallel routes although it will relieve future pressure on them.

Traffic on the Extension will consist of through turnpike trips including long-distance trips and commuters, diverted trips from other highways and induced trips. The latter consists of trips not ordinarily made under present conditions but initiated because of the availability of the new road. It is estimated that of the projected increase in vehicles during the first five years of the Turnpike Extension, 55 per cent would result from induced traffic and only 45 per cent from normal traffic growth.[2] New traffic generators along the route, such as the Prudential Center will add substantially to the traffic load.

The Turnpike Authority estimates that traffic volume along the eight-lane section will be 102,000 vehicles per day by 1970. Based on experience in other parts of the country this volume would be within the capacity of the facility.[3] The Bond Prospectus indicates that while capacity may be reached sometime after 1970, toll rates may be increased in an attempt to control volumes and prevent congestion.

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1. Bond Prospectus, Massachusetts Turnpike Authority, (January 1, 1962), p. 43.

2. Traffic and Revenues, Proposed Massachusetts Turnpike Extension, Coverdale and Colpitts (August, 1958), p. 11.

3. Highway Research Board, Committee on Highway Capacity, Observed Peak-Hour Volumes on High Traffic Flow Facilities, 1961.

The seven interchanges along the Turnpike Extension will have significant traffic impacts on local road systems. Spaced about two miles apart on the average, some interchanges will be constructed at locations where traffic is already concentrated and congestion is a serious problem. For example, Newton Corner, formed by the convergence of several major streets will also become a focal point of turnpike-oriented traffic.

While major improvements will be made by the Turnpike Authority, the estimated 28,000 vehicles that will use this interchange in 1965 will add to the traffic load of approach streets and may cause a good deal of local congestion and other traffic problems.

The interchange in Allston, 2.4 miles from the Prudential interchange is another example. This is the closest interchange to the downtown area that serves traffic in all directions and it is in this section that motorists may find the greatest savings in time. A total of 33,000 vehicles daily are expected to use this interchange for trips to and from the east. An additional 18,000 are expected to use the interchange to and from the west.

Since the Extension is expected to take three years to construct, there is adequate time to plan for the impact of these interchanges on the local street system. The Boston Redevelopment Authority has already initiated studies to determine the effect that the Extension interchanges would have on Boston's streets and traffic circulation pattern. In addition, the MTC regional traffic study of the Boston area will provide valuable data on the planning of improvements along the Extension as well as other expressways.

While initial plans for the Extension do not provide for an interchange with the Inner Belt it is expected that such a connection will be built in Allston when the Belt route is constructed. It is likely that the Allston interchange will create traffic problems in adjacent sections of Brighton and Cambridge that will require interim action until the Innter Belt issue can be resolved and the highway constructed.

Metropolitan District Commission

The Metropolitan District Commission (MDC), a state agency which concentrates most of its operations within a 15 mile radius of Boston, is responsible for some of the most important highway facilities in the Boston region. Figure 8 shows the boundary of the MDC district and the major traffic facilities under its control

Although several highway facilities fall under the juridiction of the MDC, its is not primarily a road-building agency. The majority of MDC road construction work is devoted to upgrading roads by pavement widenings, overpasses and traffic controls. Examples of this are the improvements to the Fellsway including Wellington Circle, the recently completed improvements to Soldiers Field Road as an extension of Storrow Drive and the improvements to Morrissey Boulevard.

In addition to these facilities which are part of the regional road system and fall under MDC control merely for maintenance and improvement purposes, there are roads within MDC reservations that are part of the regional road system. For example, roads in the Middlesex Fells and Blue Hills Reservations are used by through traffic not destined for these recreation areas.

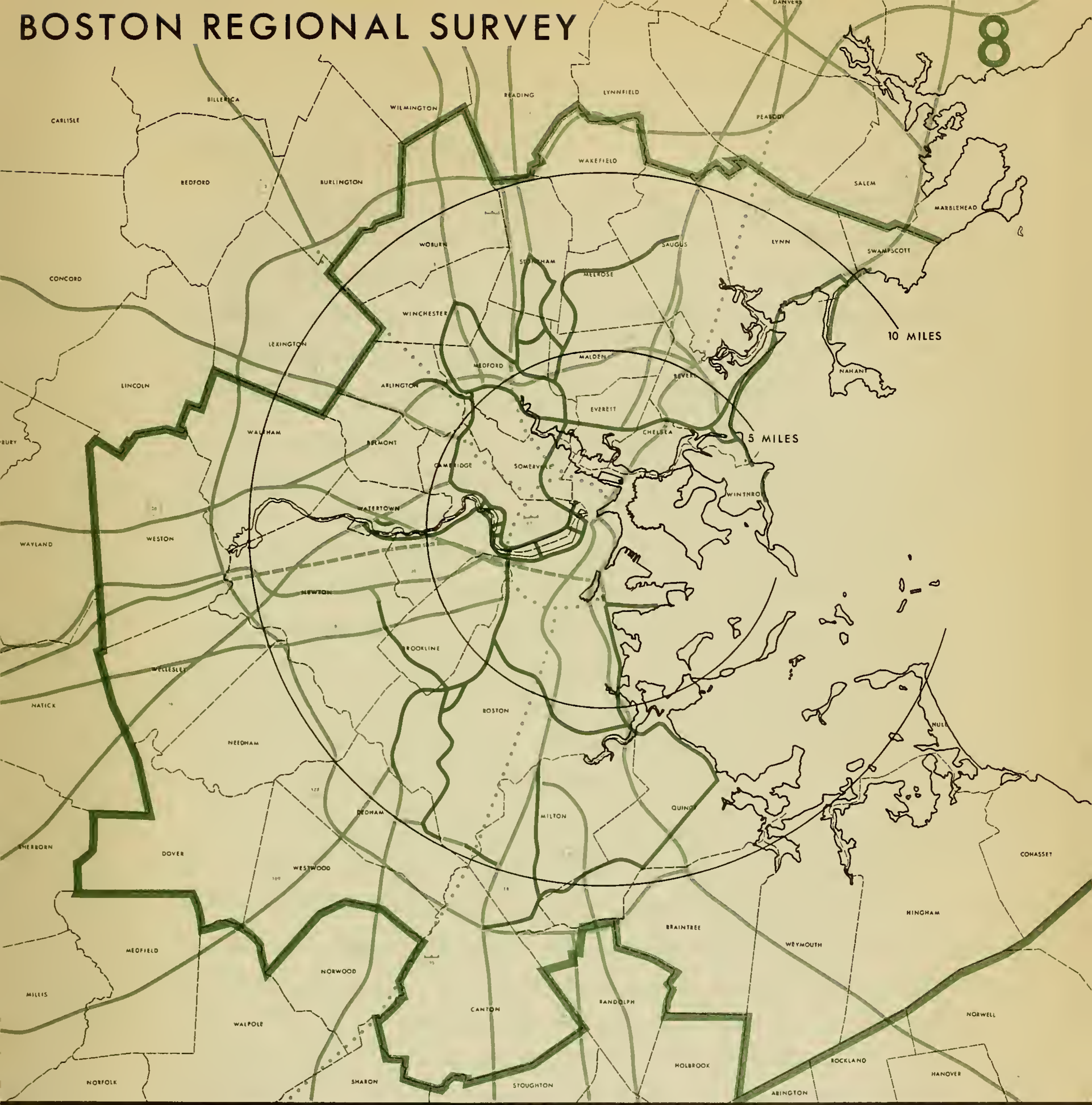
The transfer of roadways under city or state jurisdiction to the MDC must be approved by the state legislature. This legislation usually originates from the municipalities rather than from the Metropolitan District Commission.

Existing MDC Facilities

Storrow Drive running along the south bank of the Charles River is the most heavily traveled facility operated by the MDC. This road carried over 100,000 cars per day near the Esplanade, rivaling the Central Artery as the region's busiest highway. However, Storrow Drive, as well as most other MDC facilities is limited to passenger cars only.

BOSTON REGIONAL SURVEY

8



M.D.C. ROADWAYS

— M.D.C ROADWAYS

▬ M.D.C. DISTRICT BOUNDARY

SOURCE: METROPOLITAN DISTRICT COMMISSION

GENERAL INFORMATION

- EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

◆ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 SQUARE MILES

0 1 2 3 4 5
MILES

THE PREPARATION OF THIS MAP HAS BEEN FINANCED IN PART THROUGH AN URBAN PLANNING ASSISTANCE GRANT FROM THE U.S. HOUSING AND HOME FINANCE AGENCY UNDER THE PROVISIONS OF SECTION 701 OF THE HOUSING ACT OF 1954, AS AMENDED.

PREPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

The Jamaicaway is another MDC controlled route of major significance. It extends from the Boston University Bridge along a strip of park reservation as far as Forest Hills in the southern part of Boston. From here it connects with Morton Street and the Veterans of Foreign Wars Parkway, both of which are MDC roadways. The latter continues south to Route 1 as far as the Boston-Dedham Line.

Other MDC roads carrying significant traffic movements are the Lynnway, Revere Beach Parkway and Alewife Brook Parkway. The latter two roads connect several important northern radials including Routes 2, 3, 38, 28, I-93, 1, 107 and 1A. They are part of a continuous parkway development from the west Cambridge-Arlington area to the north shore beaches. In its present location this segment of parkway serves as an intermediate belt distributing traffic between the radials outside the congested core. Design standards vary along the route, but there are at least four lanes along most of it and up-to-date traffic control devices at most intersections.

In 1962 a $20 million bond issue was authorized by the legislature to provide funds for several improvements on the MDC road system. Major emphasis will be placed on upgrading Memorial Drive in Cambridge. Grade separations will be constructed at the intersections of Western Avenue, River Street and Boylston Street. These locations have been the source of frequent peak hour congestion. The Drive will be further improved by extending it from the Eliot Bridge rotary in Cambridge to Arsenal Street in Watertown. This improvement will eliminate a dead end and will provide a continuous route along the north bank of the Charles River as far west as Watertown Square where it will connect with Route 20.

Other improvements include construction of overpasses in the Charlesgate area to accommodate Storrow Drive traffic. This should have a significant impact on traffic circulation in Back Bay. This

intersection has been a continual source of congestion during the day and particularly during peak hours when traffic backs up along Storrow Drive and other roads leading into this complex district.

Another improvement proposed in this program will be the widening of Alewife Brook Parkway in west Cambridge and along the Arlington-Medford Line. No grade separations are proposed for this widened section.

Morton Street and Gallivan Boulevard, assigned to the MDC is 1956 will also be improved under the new construction program. These streets form a continuous roadway between the Forest Hills and Neponset Circle areas of Boston designated as Routes 3, 28 and 138. The MDC will eventually provide a full four-lane facility of high capacity between the above areas to serve as a high quality circumferential connecting these three important radials south of Boston.

The Parkway System

The original system of roads in the MDC parkway system was intended to provide internal access to large public open spaces, to inter-connect park and recreation areas and to link centers of population with the park system. As early as 1925, however, it was recognized that the parkway system could provide and in fact would be forced to provide automobile traffic capacity to supplement inadequate city streets.[1] The parkways with their wide borders of grass, waterways, plantings and trees were easily susceptible to widening, at first for intersection improvements and then for limited widenings and straightening of the roadways.

The 1925 report suggested that there would be a powerful incentive to defer local street improvements, which would require taking homes and businesses, in favor of widening parkways where right of way could be acquired at little or no cost. The report also pointed out that connections with major arterials would adversely affect the parkways by making them, in effect, segments of the arterial street system.

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1. Boston Park Department, Future Playgrounds and Parkways (November, 1925), pp. 44-50.

The prophecies of 1925 have been abundantly realized. Two recent examples are Soldiers Field Road where widening and intersection improvements involved cutting down large numbers of trees bordering the roadway, and the Arborway, near Forest Hills, where double-barreling the roadway eliminated a separator strip lined with trees.

In addition to these encroachments by traffic on the region's parkways, expressways have also taken large amounts of open recreational space. In the Blue Hills Reservation, Route 128 has cut a wide swath not only for the main line of the expressway, but also for a directional interchange with Route 24. To the north, Interstate 93 has virtually bisected the Middlesex Fells. At least two other expressways, I-95 South and Route 3 are expected to occupy land now classified as public open space.

The Metropolitan District Commission originated as a metropolitan community facilities agency, particularly for parks, but has in recent years emerged as a significant road construction and maintenance organization in the region. Its current emphasis is on upgrading existing roadways to high capacitylevels and maintaining them to serve some of the largest traffic volumes experienced in the area. In view of recent assignments of additional arterial streets and legislative approval of a bond issued to finance extensive improvements, this role will continue and is likely to expand in the future.

The Massachusetts Port Authority

The Massachusetts Port Authority has jurisdiction over the Mystic River Bridge and the road system serving Boston-Logan Airport. The bridge was built by a special Mystic River Bridge Authority which was dissolved when control of the Bridge was transferred to the Port Authority. Other than the operation of the bridge the Port Authority at present does not build or maintain any other facilities of regional traffic significance.

Parking Facilities

The parking situation in the Boston region cannot be analyzed in a regional perspective, but the provision of parking spaces has vital implications for the core and other parts of the region. In recent years it has been recognized that the land surrounding major intersection points on the expressway system frequently becomes highly developed requiring large parking supplies. The development of large parking areas usually requires two elements: a high degree of traffic generation and good vehicular access.

Such areas include the business districts of core cities, suburban shopping centers industrial parks, travel mode interchange points, and major recreation facilities. Such clusters of parking have already been in evidence in the region. Table 2 lists the capacity of some of the major parking facilities in the Boston region and the uses which they serve.

The first approaches to parking were generally unplanned and sporadic. Parking lots were usually small, were located on unused, remote parcels of land and parking was usually confined to ground level use only. During the last five years, however, there has been a more positive attitude toward provision of parking facilities. This has resulted from problems which have emerged as new expressways have been put into service and because the automobile has been generally accepted as a major mode of transportation to the downtown Boston area, particularly during off-peak hours.

The city of Boston has engaged in a program to provide additional parking spaces for various parts of the business district. There are now approximately 32,000 parking spaces in the downtown Boston area.[1]

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1. Robert Murphy, MIT Student Thesis "The Disappearance of Railroad Commutation in Boston, 1959.

TABLE 2

MAJOR PARKING FACILITIES IN THE BOSTON REGION

Facility	Location	Function Served	Access Routes	No. of Spaces
Northshore Center	Peabody	Shopping	Rts. 114, 128	8,000
Shoppers World	Framingham	Shopping	Rts. 9, 30, I-90	6,000
Southshore Plaza	Braintree	Shopping	Rt. 128 Southeast Exp.	6,500
Riverside Station	Newton	MTA	Rt. 128	1,600
Boston Common Garage	Downtown Boston	Shopping and Offices	Arterial Streets	1,500
Prudential Center	Back Bay Boston	Offices, Hotel, Auditorium	Turnpike Extension	4,000*
Government Center	Downtown Boston	Offices	Central Artery	2,500*
Off-Street Spaces	Downtown Boston	Shopping, Offices	Arterial Streets	26,000

* Under Construction

Source: Robert H. Murphy, M. I. T. Student Thesis; The Disappearance of Railroad Commutation in Boston, 1959, and other sources.

(As a comparison there are a total of 20,000 parking spaces in the region's three largest suburban shopping centers.) Of these, about 26,500 are in off-street locations and 5,500 are at the curb. The majority of curb spaces are metered. In addition to these legal spaces there are an estimated 3,500 additional regularly used, illegal spaces.

The General Plan for the Central Business,[1] estimates that an additional 10,000 off-street spaces are needed in downtown Boston. Major portions of this goal have already been translated into positive action. The underground Common Garage, completed in late 1961 provided 1,500 spaces. The new Government Center Project, under construction in late 1962, will initially provide 1,600-2,000 spaces in a main garage structure. Other parking facilities in the project will provide an additional 500-1,000 spaces. The Prudential Center will provide 2,500 spaces initially with additional spaces to be provided by a hotel now under construction. In October, 1962, plans were presented to provide an additional 1,000-car parking facility for the Prudential Center at the city auditorium.

In addition to parking terminals that are definitely planned, several proposals for other parking facilities have been made. The South Station area has been suggested as a possible location for a 7,000 car parking facility, although this large number of spaces may be difficult to provide in one location because of operational difficulties. A major parking terminal in this same location was proposed in 1955 in a report prepared for the Boston Terminal Corporation. The report recommended a facility that would provide 1174 spaces.[1] The report pointed out (but did not recommend) that direct ramps from the Central Artery to the garage could be built.

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1. Boston Redevelopment Authority, A General Plan for the Central Business District, Boston, 1960.

2. Feasibility Study, The Boston Terminal Corporation, Parking Garage, Clarkeson Engineering Company, Boston, 1955.

The Boston Redevelopment Authority is currently studying the possibility of providing major parking facilities at the interchanges of the Turnpike Extension. No specific proposals as to location,design, or who would build them has been made as of October, 1962. Parking at these locations, close to interchanges would have the effect of reducing the amount of traffic on the downtown arterial street system. This would be accomplished by intercepting automobiles coming off the Turnpike before they reach the local street system. Boston has $5 million remaining from bond issues which could be spent on parking garages to advance this program.

In addition to core parking facilities, the region contains a number of very large parking terminals in the suburbs. For example, the three major regional shopping centers in Peabody, Framingham and Braintree each have between 6,000 and 8,000 parking spaces.

The Metropolitan Transit Authority also utilizes large fringe area parking lots to accommodate commuters. The MTA maintains a total of approximately 5,800 parking spaces. Some of the larger lots include Everett (400), Lechmere (385) Wonderland (480) and Riverside, the largest, (1,600). The MTA plans to construct additions to its parking facilities. In particular, proposals for rapid transit extensions involve construction of large parking areas at intermediate and outer terminal stations.

The actions and proposals outlined above point out the extent to which parking facilities are now being planned, in contrast to earlier haphazard approaches. They also point out the change in the magnitude of parking facilities which has taken place in Boston. Small lots are no longer considered viable. Virtually all single facilities mentioned will provide space for a minimum of a thousand cars. Unlike the highway system, however, the general responsibility for the planning and construction of off-street parking has not been clearly defined. The underground Common

Garage was built by a special authority, the initial parking supply of the Prudential Center will be supplied by the developer, the city auditorium parking garage will be constructed by the city. The only major unified parking program undertaken by a city in the region has occured in Boston. During the late 1950's, the city engaged in a parking garage program to ring the downtown business district. Two $10 million bond issues were authorized for this purpose, one in 1946 and another in 1955. A total of about $15 million has been spent so far in this program.

Despite the lack of centralized control over parking, current plans by a variety of agenices indicate that there is coordination between these agencies. Also recognition has been given the need for parking to accompany highway improvements and the construction of traffic generators. As recently as 1955, when the Central Artery was constructed, little attention had been given to the possibility of providing parking facilities beneath or in conjunction with the elevated structure. However, since that time several locations have been developed for parking. A design of the Central Artery specifically incorporating under-structure parking would have created a much greater parking supply along this route. Only one garage, at the High Street exit, provides direct access from the expressway.

Trucking Facilities

Trucking activity has increased in the region at the expense of local railroads in line with national pattern. Employment figures tell the story: During the 1950-1960 decade railroad employment in the nation declined by 400,000 while the trucking industry increased by 200,000 jobs.

As a percentage of the traffic stream, trucks in the region generally compose about ten to twenty per cent of the flow, a pattern which is comparable to other metropolitan areas. Some parts of the region, however, experience much larger percentages of truck movement. For example, a recent study in highly industrialized Cambridge found that the percentage of trucks in the traffic stream ranged between 20 and 40 per cent.[1]

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[1] Cambridge City Planning Board, 1961, unpublished data.

There are no major concentrations of truck terminals in the region. Perhaps because of this no regional studies of trucking patterns and terminal needs has been made. The greatest concern in terminal development has been shown by the city of Boston. In 1946 a plan was prepared to guide the growth of truck terminals within the city.[1] This report recommended construction of one or two terminals close to the downtown area, one north and one south of the CBD. It was estimated that nine acres would be needed for both terminals whose combined capacity would be approximately 200 spaces. The city is now in the process of preparing renewal plans for its downtown area which will include specific recommendations for trucking facilities.

Some trucking firms have located major terminals in the suburbs along Route 128 and along the radial highways where company shipments are consolidated for final delivery.

The Boston Regional Transportation study should develop specific recommendations concerning the location of truck terminals in the region. In addition, study should be made of the possibility of load consolidations to reduce truck traffic and loading requirements in congested areas.

Total Regional Highway Expenditures

The largest share of regional highway expenditures is derived from the Massachusetts Department of Public Works which expends both state and federal funds for construction, improvement and maintenance of the regional highway system. The other major road building agencies, the Massachusetts Turnpike Authority and the Metropolitan District Commission also invest considerable sums in the highway system. The Port Authority contributes through maintenance of the Mystic River Bridge and approach roads to Boston-Logan airport. In addition, each community is responsible for building, improving and maintaining most of the roadways within their jurisdictions.

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[1] Report on a Union Motor Truck Terminal for Boston, Boston City Planning Board, October, 1947.

The Department of Public Works

The Department of Public Works spends a major portion of its funds in the region which includes 60 per cent of the state Interstate Highway mileage and most of the costly urban construction. Many of the region's roads traverse densely built-up areas and tend to be substantially more costly than roads elsewhere in the state.

The federal government contributes substantial aid to highways through the national system of Interstate and Defense Highways. Under the Interstate Program the federal government contributes 90 per cent of all construction costs, the state 10 per cent. Another system, identified as the ABC System includes federally aided primary, secondary, and urban routes. Federal participation in each of these systems amounts to 50 per cent of the total cost of construction with the state normally contributing the remaining 50 per cent.

In 1960 the state Department of Public Works received $86 million in federal funds for federal-aid Interstate highway construction. The state's share in this program was $24 million for a total appropriation of $110 million Table 3 shows federal and state expenditures in Massachusetts.

Future estimated expenditures for expressways in the Boston region are shown in Table 4. It is anticipated that a total of $393 million will be spent by the DPW in the Boston region before 1975 in interstate highways alone. In addition, another $99.5 million is expected to be spent on other federally aided expressways and $147 will be spent for the Turnpike Extension. None of these figures include improvements and new sections of roadways that are not part of the expressway system or maintenance costs on existing portions of the highway system.

In addition to participation in the federal aid systems, the state contributes to local road financing through the Chapter 90 and Chapter 81 programs. The Chapter 90 program provides a limited amount of state highway funds to be spent, together with matching funds from the

TABLE 3

ESTIMATED COST TO COMPLETE BOSTON REGION EXPRESSWAY SYSTEM

Highway	No. of Miles	Estimated Cost (000's omitted)
Interstate System		
Inner Belt (695)	7.1 or 6.2	$129,600
Outer Belt (495), Various Segments	79.3	120,600
Northeast Expressway (95) Danvers - Revere	11.8	30,200
Northeast Expressway (93) Medford - Inner Belt	1.8	10,900
Massachusetts Turnpike (90) Rt. 128 - Central Artery	11.5	180,000
Southwest Expressway (95) Foxborough-Inner Belt	26.8	101,700
Total Interstate		573,000
Other Federal-Aid Expressways		
Route 128 Widening (Rt. 93-Rt. 9)	16	29,000
Route 3 (128 - Cambridge)	7	22,000
Route 2 (Acton - Inner Belt)	19	41,000
Route 3 (Duxbury)	6	4,000
Route 3 (Tyngsborough)	3	3,500
Total Other Expressways		99,500

Note: The recent Inner Belt report included costs for core area sections of the expressway which in general are considerably higher than those in the table. For example, the total cost of the Inner Belt was estimated at $168.8 million, as compared to $129.6 million in the table.

SOURCE: A Report of Progress to Governor John A. Volpe, Massachusetts Department of Public Works, Fall, 1961.

TABLE 4

FEDERAL AID RECEIVED BY MASSACHUSETTS AND REQUIRED MATCHING FUNDS: 1946 to 1960

Year	Federal Aid (000's)	State Matching Funds (000's)	Total
1946	$10,342	$10,342	$20,684
1947	10,342	10,342	20,684
1948	10,208	10,208	20,416
1950	9,188	9,188	18,376
1951	9,196	9,196	18,392
1952	8,933	8,933	17,866
1953	8,849	8,849	17,698
1954	10,156	10,156	20,312
1955	10,225	10,225	20,450
1956	16,356	15,138	31,494
1957	40,014	19,817	59,831
1958	52,063	19,801	71,864
1959	62,891	22,109	85,000
1960	85,876	24,124	110,000

Source: U.S. Department of Public Works, Highway Statistics, 1955 Summary, Washington U.S. Government Printing Office: and Massachusetts Department of Public Works.

Note: No information available for 1949.

municipality and county, for maintaining, repairing, improving and constructing municipal and county highways. Although selection of projects is in local hands, the administration and direction of the program in under the control of the Department of Public Works. The Chapter 81 program provides for the expenditure of funds for the repair and improvement of public ways other than state highways in towns having valuation of under $5 million and a road mileage ratio based on state tax and local mileage. The state contributes $275 per mile and the municipalities $15 to $150 per mile, depending on the road mileage ratio.

Chapter 90 construction financing is usually determined by a ratio in which the local community contributes 25 per cent of the cost of a project, the county provides 25 per cent and the state highway department provides 50 per cent. The allocation of Chapter 90 funds among the state's municipalities from the Department of Public Works is based on a formula which includes population, town area and road mileage. Within the Boston region, Chapter 90 assignments for 1961 totalled $6.4 million, including state, county, and local contributions. This figure represents a little under 50 per cent of total statewide Chapter 90 expenditures.

In addition to these funds, the smaller communities which qualify for Chapter 81 funds received additional aid. Within the Boston region 48 communities were eligible for Chapter 81 funds in 1962. Total Chapter 81 funds assigned to these communities in 1962 was $965,000. This includes the local contribution to the Chapter 81 program which averages about 25 per cent of the total amount. Chapter 81 funds may be used for snow removal and sanding operations up to a predetermined maximum.

A one-time input of local highway construction funds occurred in 1956 when Chapter 718 of the Acts and Resolves of the State Legislature, which provided funds for State highway construction, contained a provision which allotted a specific amount of money to each community in the state to be spent for the improvement or construction of roads. A total of $15 million

was provided for this purpose. While the overall effect was beneficial, some communities used these funds as their contribution to the Chapter 90 program.

In summary, over $7 million is spent annually on the DPW controlled Chapter 90 and Chapter 81 programs. About half is contributed from DPW funds and the remainder by counties and local communities.

Massachusetts Turnpike Authority

Although the Turnpike Authority controls a relatively small amount of roads in the region (about 26 miles of the Turnpike and the 12 mile Extension under construction), the high cost of its facilities make it the second largest contribution of highway funds in the region.

Since 1954 when the initial Turnpike was put under construction the Authority has spent about $48 million for the 26 miles of Turnpike within the region,[1] $32 million for the construction of the Callahan Tunnel and modernization of the Sumner Tunnel and has begun $147 million worth of construction to build the Turnpike Extension into Boston.[2] With the Turnpike Extension expected to be completed by 1965, the Authority will have spent approximately $227 million for highway construction in the region in an eleven year period.

Because the Turnpike must provide superior all-weather service to attract customers and must also collect tolls, its operating costs are quite high. The Authority estimates that for the Extension, maintenance and operating costs during the first year of operation will total $975,000. They further estimate that for each succeeding year the total will be increased by an average $130,000 annually.

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1. Based upon the average cost per mile of the entire turnpike.
2. These figures for Turnpike Authority construction are less than total bonds issued. Total bond issues include interest costs during construction, initial operating costs, professional fees and other expenses normally incurred.

Metropolitan District Commission

The Metropolitan District Commission is also an important highway financing agency in the Boston region. Generally speaking the expenditures of the MDC may be divided into three categories: new construction, reconstruction, resurfacing and maintenance.

In new construction, an average annual figure is difficult to determine since funds for new construction are not allocated on an annual basis. In 1956, $16 million out of a $200 million bond issue approved by the state legislature for highway improvements was allocated to the MDC. At that time an additional $15 million from prior issues remained unspent. It is estimated that between 1957 and 1961 a total of $27 million was spent on new construction by the MDC.

In 1962 a $20 million Highway Construction Program was announced by the Metropolitan District Commission. As in similar previous construction programs emphasis was placed on increasing the capacity of existing MDC facilities. As was noted above, under the proposed program several grade intersections along Memorial Drive, River Street, Western Avenue and Boylston Street are to be converted to grade separated structures, similar to the program which converted Soldiers Field Road to a limited access facility.

It has been estimated that annual expenditures by the MDC for resurfacing amount to about $300,000 per year. However, it is expected that in the future this figure may increase in view of the many new roads that have been assigned to the MDC. It is estimated that the Metropolitan District Commission spends approximately $10 million per year to maintain their network of roads. Of this amount approximately $4 million per year is spent on snow removal and other operational costs.

Massachusetts Port Authority

Insofar as regional highways are concerned, the Port Authority is not engaged in construction of new facilities. Its only expenditures on regional highways are for maintenance and operation of the Mystic River Bridge for which it expends about $700,000 annually.

Local Road Expenditures

Expenditures for local roads and streets are derived from a variety of sources and are difficult to estimate. Most local road funds are spent on maintenance and snow plowing. These funds, as well as other amounts allocated for repair or construction of small segments of roadway, are often not identified in the budgets of local public works or highway departments. Maintenance is usually limited to filling pot holes, weed control, snow plowing and resurfacing. Frequently, the local highway department will perform the required road construction work in connection with Chapter 90 and Chapter 81 projects.

Local authorities spend less on roadway improvements (outside of Chapter 90) than the other road building agencies, but are responsible for most of the mileage in the region. However, local roads accommodate only a small portion of the region's total vehicle mileage.

Summary

Highways accommodate most of the trips made in the Boston region. Responsibility for construction and maintenance of the highway net is divided among several agencies. The Department of Public Works is the most important with regard to the amount of money that is spent on highways and in the number of vehicle-miles of travel accommodated.

Because various agencies are responsible for various elements of the highway system, the costs of additions and improvements, maintenance and operation are difficult to define and measure. However, it is estimated that approximately $90 million will be spent annually for new construction and major reconstruction projects in the region during the next several years.

The lack of an overall authority to guide the development of the road system had led to congestion in several areas caused by a lack of coordination between various agencies. Concentration on traffic arterials coupled with neglect of feeder streets has resulted in severe congestion, particularly in the core communities. This situation will become progressively worse if the state continues to spend large sums of state and federal funds for expressway construction and leaves the feeder system to be financed primarily by inadequate local funds.

4. TRAFFIC CHARACTERISTICS

Traffic flows are the result of a number of variable inputs including population growth and distribution, car ownership and usage, economic activity and highway capacity restraints. On the average, each vehicle in the Boston area travels about 10,000 miles per year: the location and timing of this travel is of great significance in highway planning.

Traffic volumes, in a sense, measure the pulse of the highway system. Analysis of traffic volumes helps to identify sections of roadway that are overloaded or approaching capacity as well as those sections that are being underutilized. Comparison of traffic volumes at specific locations over a period of time gives an indication of the traffic growth accommodated by the various segments of the highway system.

Traffic Volumes

The Department of Public Works maintains an extensive traffic counting program on the state highway system. Many locations in the region are counted 24 hours per day the year round. Other points are counted one week each month and some points less frequently. This program results in an up-to-date picture of traffic volumes. Much of the traffic volume data in this report has been taken from DPW counts.

The pattern of traffic volumes encountered in the region is similar to that in other major urban areas. The heaviest volumes are found in the region's hub. The Central Artery which carries the heaviest volume of traffic,at one point carries 110,000 vehicles per day on a six-lane section near High Street. Storrow Drive currently carries 80,000 vehicles per day along the six-lane section east of Massachusetts Avenue, and about 100,000 per day near the Esplanade. Table 4 presents 1960 traffic volumes at selected locations throughout the region, particularly some of the more heavily used facilities.

Less than ten years ago traffic volumes of this magnitude were unknown in the Boston area but in recent years construction of high-capacity, limited-access roads has permitted an unprecedented volume of traffic to funnel onto major routes. In 1951 maximum volumes in the region were in the 40,000 to 50,000 vehicles-per-day range. Within a period of 10 years, maximum volumes in the region doubled. This is illustrated in Figure 9 which shows traffic flow, for 1951 and 1960.

Some traffic facilities show spectacular growth for the decade. On Route 128, for example, volume on the four-lane section in Waltham and Lexington more than doubled, rising from 21,000 vehicles per day in 1951 to 42,000 vehicles per day in 1960.

An even more spectacular growth occurred along the southern portions of Route 128 where in 1951 the roadway consisted of two to three lanes. After the old road was replaced by a six-lane facility traffic volumes on this section quadrupled. For example, in 1951, the daily volume on a two-lane section of Route 128 east of Route 1 was 8,400. In 1960 the same segment widened to six lanes, carried 35,700 vehicles per day.

This great increase resulted from improved alignment,widening and access control of the highway which provided additional traffic capacity. There is no doubt that part of this increase in traffic occured as a result of providing an outlet for latent traffic demand, but most of the volume probably resulted from diversion of traffic from other more congested routes.

Within the core cities, traffic volumes as high as 30,000 to 40,000 vehicles per day have been in evidence for at least three decades. Key facilities such as bridges, major arterials and other important segments of the circulation system carry these volumes regularly.

In many cases these volumes reflect existing street capacity and are not representative of higher volumes that could be carried if traffic capacity were increased. Typical average daily traffic volumes encountered on

TABLE 5

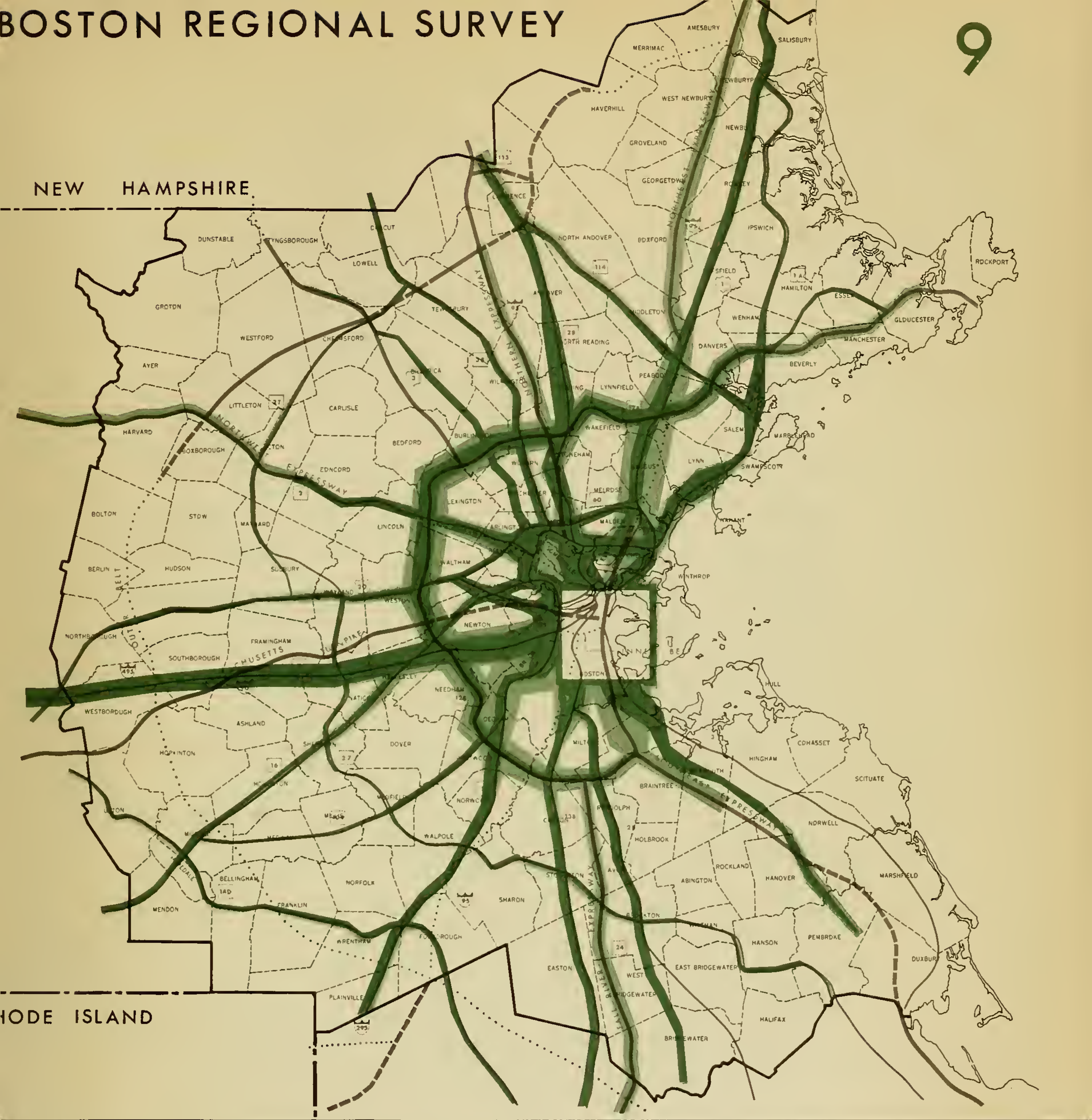
AVERAGE 24 HOUR VOLUMES ON SELECTED MAJOR ROUTES IN THE BOSTON REGION, 1960

Route	Location	1960 Average Daily Traffic
Central Artery	High Street Exit to Sumner Tunnel	110,000
Storrow Drive	East of Massachusetts Avenue	80,000
Mystic River Bridge	Mystic River	58,340
Southeast Expressway	Neponset River	51,200
Route 1	Saugus, South of Route 129	46,190
Route 128	Lexington, South of Route 2	42,370
Blue Hill Avenue	Boston-Mattapan Square	39,930
Route 128	Reading, East of Route 28	29,490
Route 1	Westwood, South of Route 128	27,310
Route 128	Randolph, East of Route 28	21,380
Route 9	Framingham Center	20,300
Route 28	Lawrence at Andover Line	14,060
Main Street	Woburn at Winchester	12,060
Route 128	Beverly-Wenham Line	11,520
Route 2	Acton, East of Route 27	10,450
Route 109	Medway, West of Route 126	2,950

Source: 1960 Traffic Flow Map, Massachusetts Department of Public Works and other sources.

BOSTON REGIONAL SURVEY

9



TRAFFIC VOLUME FLOW MAP, 1951 AND 1960

🟩	1951
🟩	1960

ADT (000)
20
40
60

SOURCE: MASS. D.P.W. ANNUAL FLOW MAPS

GENERAL INFORMATION

- EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1
2560 ACRES
SQUARE MILES

0 5 10 MILES

EPARED FOR THE MASS TRANSPORTATION COMMISSION
BY THE PLANNING SERVICES GROUP, CONSULTANTS

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TABLE 6

DESIGN CAPACITIES EXPRESSED AS 24 HOUR TRAFFIC VOLUMES

Area Type	Street Width		
Arterials	20'	40'	60'
Downtown	5,100	11,400	10,100
Intermediate	6,400	14,000	23,000
Outlying and Rural	7,000	15,300	23,000
	Number of 12' lanes		
Expressways	4	6	8
All Areas	54,000	81,000	108,000

Source: Chicago Area Transportation Study, Volume I, Page 79

arterials in core areas are: Boston University Bridge, 35,000 Massachusetts Avenue in Central Square Cambridge, 20,000. Many of these streets are carrying volumes that are close to or exceed their capacity. Table 6 shows the capacity volumes for various types of streets.

As they cross Route 128, the region's major radial arterials carry volumes generally ranging between 20,000 and 40,000 vehicles per day. For example, Route 9 carries 34,000; Route 1 north carries 40,000; Route 1 south, 27,000; and Route 2, 21,000 vehicles per day. Beyond Route 128 volumes on these radials decline to 10,000 - 20,000 vehicles-per-day levels; the volumes level off as these roads assume the role of rural highways connecting major cities throughout the state. On routes in the areas between the major radials, lower traffic volumes prevail, in most cases running below 10,000 vehicles-per-day.

The 10,000 vehicle-per-day level is frequently the maximum volume found in many of the suburban residential communities that have experienced strong growth over the past decade and may indicate the practical capacity ceilings of local streets and highways. These suburban centers may experience increasing highway congestion as more automobiles are registered in the suburbs, and more trips are made to and from suburban origins and destinations.[1]

In larger outlying communities such as Lowell, Lawrence, and Framingham, volumes in the centers begin to approach those encountered in the core area. For example, in the Lawrence area, volumes on key arterials are about 20,000 vehicles per day and on one bridge, daily volume reaches 35,000.[2]

A large part of the road mileage in the region is composed of two-lane roads connecting rural and suburban population centers in the less densely settled communities in the region. Although most of these roads

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1. Travel in the Boston Region, Boston College Seminar Research Bureau.
2. Lawrence Traffic Report, Highway Traffic Engineers, 1958. Based on ten hour counts.

carry volumes below 5,000 vehicles per day, in some cases their traffic volumes are high in relation to their capacity. In many instances, however, rural roads can absorb additional traffic volumes and this will help to accommodate part of the great increase in vehicle mileage expected in the outlying areas of the region. However, their contribution to relieving the region's most intricate and costly traffic problems is limited by the fact that most of these roads lie beyond Route 128, outside the more congested portions of the Boston region.

In addition to suburban population growth, future increases in traffic will be the result of increased vehicle ownership as more suburban families acquire a second or even third automobile. It is quite likely that most travel in second and third cars will be confined to the suburban and rural portions of the region. Furthermore, many of the trips made by these vehicles will probably occur during off-peak travel periods. Thus, although increases in vehicle ownership and mileage will raise daily traffic levels on rural roads, this may not necessarily raise the critical peak hour flows.

Peak hour congestion occurs frequently in certain suburbs. A typical situation is where concentrations of industry are surrounded by extensive low-density residential development, as in Canton, Wayland and Bedford. During the morning and evening peak hours roads approaching the industrial areas are crowded with commuters while at other times of the day the roads are virtually free of traffic.

Traffic Growth

Before 1945 traffic volumes in the region grew at a rate under 3 per cent per year. From the end of the war to the mid-1950's, the area experienced a much faster rate of growth; between 1950, and 1955 traffic volumes grew between five and six per cent per year. However, the growth rate has decelerated in recent years; traffic volume in the region since 1955 has been increasing at a rate of between 3.5 per cent and

4.0 per cent annually.[1]

Vehicle travel growth in the nation has been climbing at a rate of about four per cent per year. Despite the region's relatively lower rate of population expansion, the region's traffic growth is similar to other areas. Thus, per capita travel in the Boston region appears to be growing more rapidly than in the nation. In the 1950 decade, population in the region grew at an average annual rate of less than one per cent or about half the national rate. Therefore, vehicle travel per person in the region increased at twice the national average during the 1950-1960 decade. One probably cause of this large increase in per capita travel is the great amount of highway capacity that became available in the region in the 1950-1960 period which permitted a massive shift in travel habits.

In the future, however, vehicle mileage in the core cities will probably be limited by highway capacity. (As an example, Figure 6 shows 1975 traffic assignments to the Inner Belt if capacity were no problem). These assignments are two and three times the capacity of the highway. It will be impossible to satisfy this demand with vehicular facilities alone.

In all likelihood, traffic volumes will continue to grow at a rapid rate during the next ten years, partly because of the completion of major portions of the region's expressway system. With their high traffic capacities these facilities will absorb a significant proportion of new vehicle mileage generated during the coming decade.

In addition, traffic volumes and capacities on the region's arterial street system will increase as the result of extensive improvements. The arterial street system, which was somewhat neglected during the postwar period, is now being considerably up-graded. A few examples of this

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[1] Estimates based on traffic volume information issued by the DPW.

upgrading are the major improvements to Blue Hill Avenue and McGrath Highway in Boston, traffic control measures such as at Wellington Circle in Medford, and reconstruction of Route 1 in Norwood. Furthermore, stringent enforcement of parking regulations, particularly in the core cities, will further increase traffic capacity and traffic volumes.

It has been estimated that total vehicle-miles in the nation will increase from 728 billion in 1960 to 1,277 billion vehicle-miles in 1980, an increase of 76 per cent over the 20 year period.[1] This increase averages 3.8 per cent annually. The Boston region will probably keep pace with this projected national increase particularly in view of the additional high quality arterial and expressway mileage that will be available in the next twenty years.

Rapid transit extensions may relieve peak hour congestion in the core area but it is unlikely that they would appreciably reduce the projected growth of vehicle-mileage and traffic volumes. However rapid transit improvements would probably succeed in reducing volumes to more tolerable levels and would help to absorb future demands.

Automobile Registrations

Vehicle registrations and the persons-per-vehicle ratio[2] displays the same pattern in the Boston metropolitan area as in metropolitan areas throughout the country. In the high density core and in the outlying cities the persons-per-vehicle ratio is higher than in the low density suburban communities where car ownership is a necessity. In addition to location, ownership patterns are also affected by income. Higher income communities have lower-than-average ratios(more cars per family). Figure 10 shows the persons-per-vehicle ratio for communities within the region.

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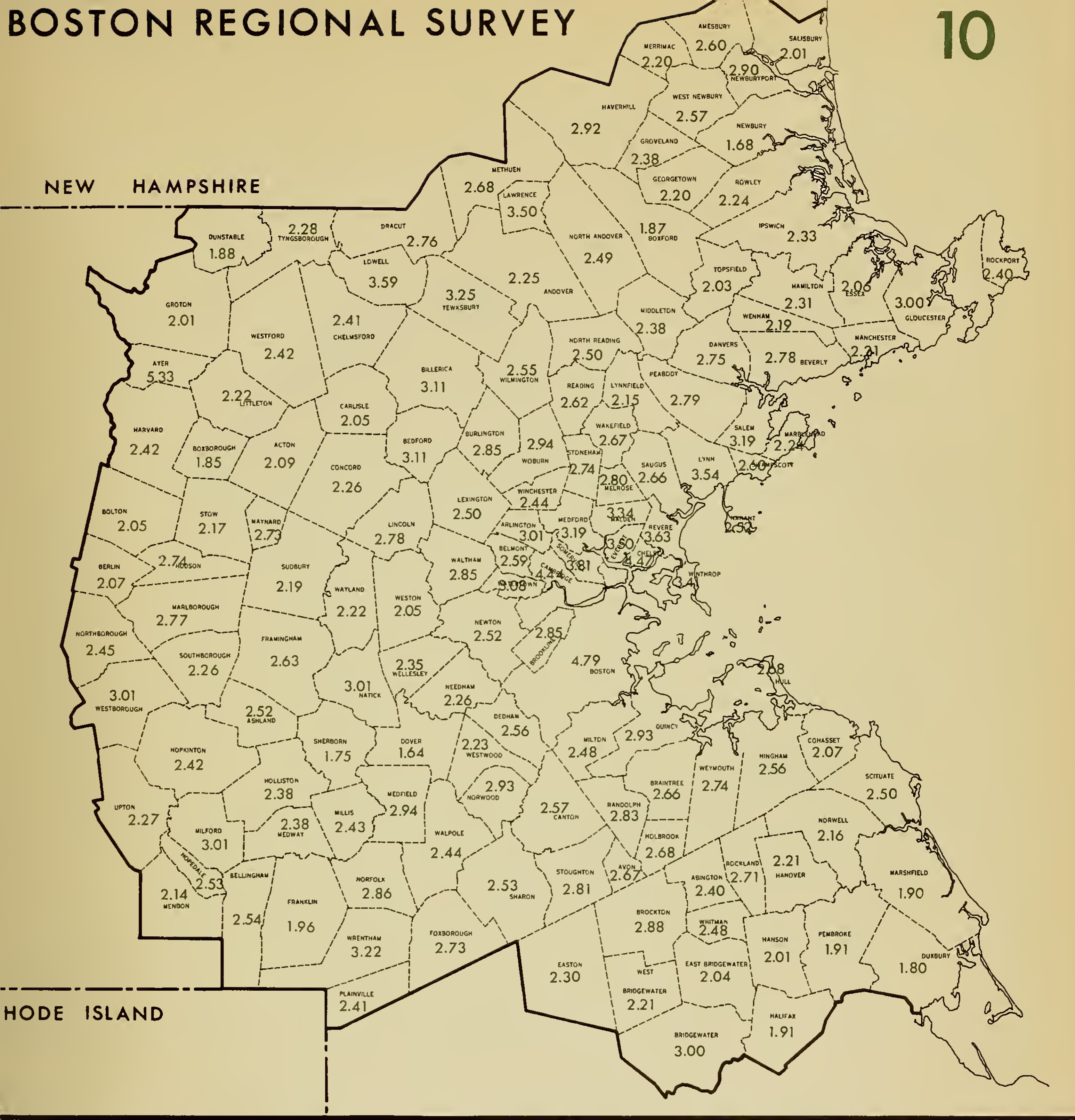
1. Future Highways and Urban Growth, Wilbur Smith and Associates New Haven, 1961, pp. 202.

2. A measurement of vehicle ownership, arrived at by dividing population by the number of vehicles registered.



VEHICLE OWNERSHIP RATIO, 1960

PERSONS/MOTOR VEHICLE

SOURCE: U. S. CENSUS AND MASS. DEPT. OF CORP. AND TAX.

GENERAL INFORMATION

- ☐ EXPRESSWAYS
  - UNDER CONSTRUCTION
  - PROPOSED
- ☐ MAJOR HIGHWAYS
- ☐ SECONDARY HIGHWAYS
- ☐ MAJOR RAILROADS
- ☐ SECONDARY RAILROADS
- ☐ RAPID TRANSIT LINES

▲ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

NORTH

1 2560 ACRES
SQUARE MILES

0 5 10 MILES

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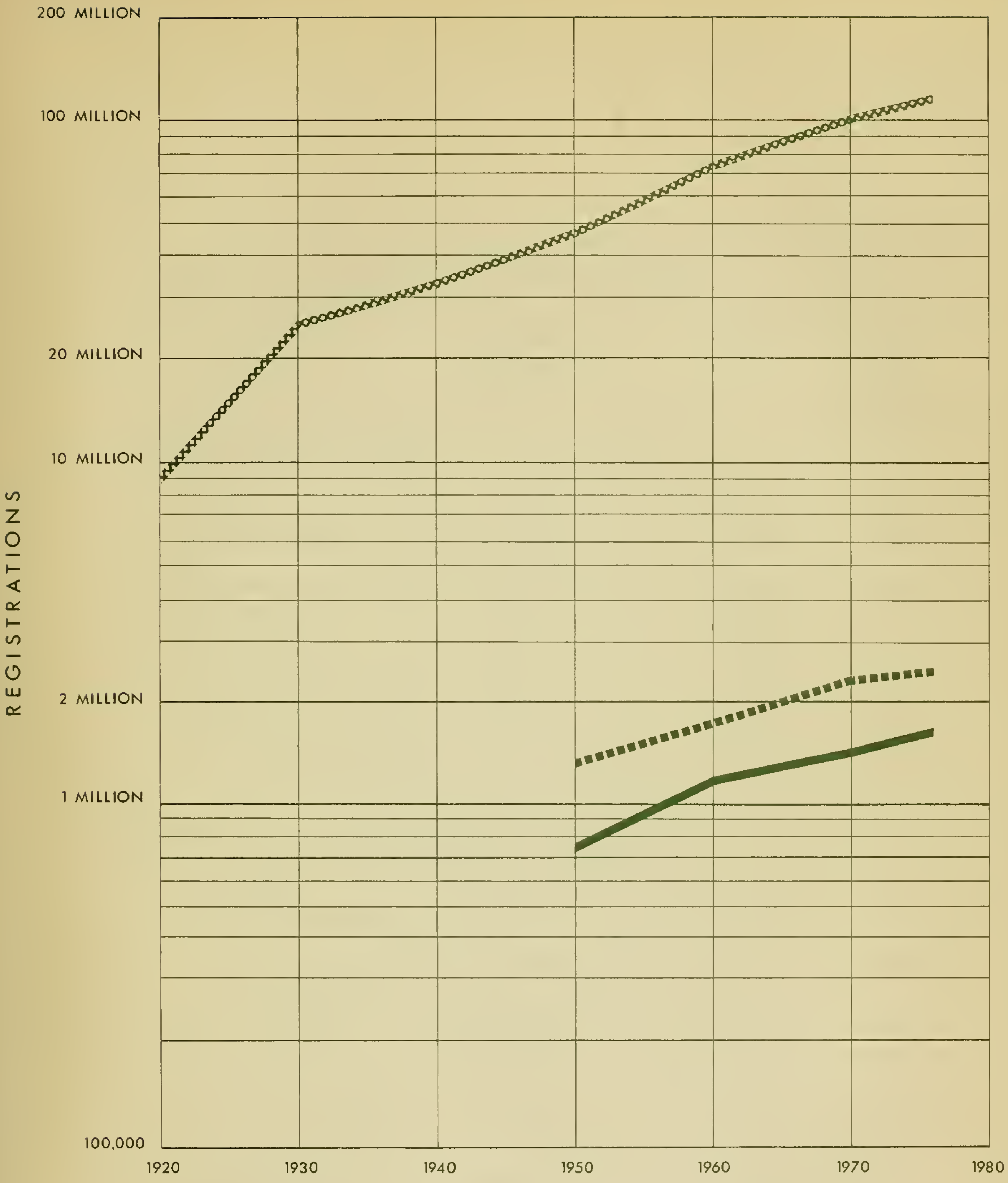

VEHICLE REGISTRATION TRENDS

▬ BOSTON REGION
■■■■■■■■ MASSACHUSETTS
xxxxxxxxx UNITED STATES

SOURCE: MASS. DEPT. OF CORP. AND TAX.

TABLE 7

1960 MOTOR VEHICLE REGISTRATION IN SELECTED UNITED STATES COUNTIES AND PERSONS PER VEHICLE RATIOS

Country (Major City)	Vehicle Registrations 1960	Population 1960	Persons per Vehicle
Counties in Massachusetts			
Middlesex (Cambridge)	410,581	1,238,742	3.0
Suffolk (Boston)	197,289	791,329	4.0
Worcester (Worcester)	202,971	583,228	2.9
Essex (Lynn)	195,323	568,831	2.9
Norfolk (Quincy)	182,497	510,256	2.8
Hampden (Springfield)	147,816	429,353	2.9
Bristol (Fall River-New Bedford)	139,252	398,488	2.9
Counties Outside Massachusetts			
New York (Five Boroughs)	1,431,542	7,781,984	5.6
Los Angeles (Los Angeles)	2,876,100	6,038,771	2.1
Cook (Chicago)	1,594,556	5,129,725	3.2
Philadelphia (Philadelphia)	524,327	2,002,512	3.8
District of Columbia (Washington)	272,665	763,956	2.8
San Francisco (San Francisco)	300,830	740,316	2.5
Hartford (Hartford)	253,472	689,555	2.7

Source: Automobile Manufacturers Association, Automobile Facts and Figures, 1961 (Detroit: AMA Inc., 1961), pp. 22-23 and U.S. Census of Population, Final Report, Total United States: Number of Inhabitants.

NOTE: Vehicle Registrations include Cars and Trucks.

Table 7 shows vehicle registrations by county for the heavily populated areas in Massachusetts as well as in other parts of the nation. Suffolk County (Boston) has a ratio of 4. 5, the highest persons-per-vehicle ratio in Massachusetts. A high ratio is normal in a large city where incomes are lower than in surrounding communities, where automobile ownership is more expensive in terms of insurance and garaging and where substantial mass transportation facilities are available: Boston is second only to New York in the nation in persons-per-vehicle.[1]

The persons-per-vehicle ratio in most urban areas in Massachusetts falls between 2. 8 and 3. 2. In urban areas elsewhere in the nation, persons-per-vehicle ratios cluster in the 2. 5 - 3. 0 range, indicating greater per capita automobile ownership elsewhere. Many of the nation's urban areas do not have a well developed mass transportation system and are therefore more dependent on automobile transportation than the Boston region. Nationally, the persons-per-vehicle ratio is 3. 1.

Within the region, the core communities have the highest ratios. Most communities in the region fall in the 2. 5 to 3. 0 but somewhat lower persons-per-vehicle ratios are evident in a ring of higher income suburban communities immediately outside Route 128.

The person-per-vehicle ratio for the region as a whole declined from 3. 9 in 1950 to 3. 1 in 1960. For the state of Massachusetts the comparable figure for 1950 was 3. 6 and for 1960, 2. 9. The lower state figures are accounted for by the low density development and lack of extensive mass transportation characteristic of much of the remainder of the state.

Figure 11 indicates vehicle registration figures trends for the Boston region, Massachusetts, and the nation. During the 1950-1960 period the region experienced a 37 per cent increase in registrations as compared to a 30 per cent gain in the remainder of the state. However, during the decade

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1. Includes New York City's five boroughs.

the national increase was 50 per cent.

In 1950 the region contained 781,000 vehicles as compared to 501,000 for the remainder of Massachusetts. In 1960 the comparable figures were 1,072,000 for the region and 661,000 for the remainder of the state.

Within the region the rate of growth of vehicle registrations has varied. Among outlying central cities, fast-growing Brockton experienced the highest rate of growth during the past ten years, with a 37 per cent increase during this period. Lawrence, whose population declined, had the lowest rate of increase during the 1950-1960 decade; its increase amounted to only 13 per cent. During the same period registrations in Haverhill increased by 23 per cent and in Lowell by 30 per cent. Boston which suffered a substantial population decline nevertheless increased by nine per cent in registrations.

Travel Times

Travel times within Route 128 have not decreased significantly, despite the large amount of money that has been spent on highway improvements in the region during the past 30 years. Certain core trips which utilize existing expressways show a major improvement since 1930, but on the average, core area automobile travel is still slow.

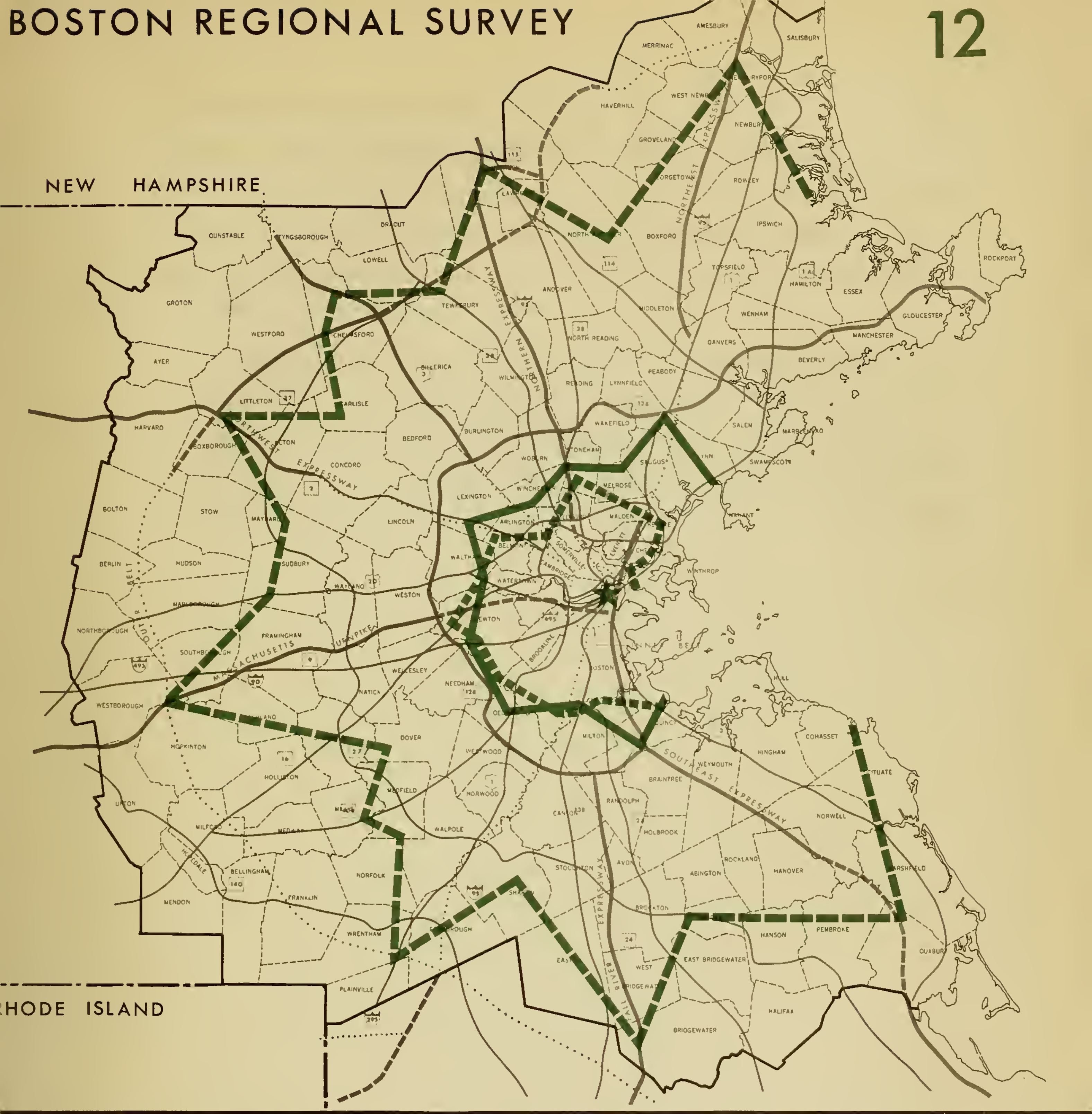
Although travel times beyond Route 128 are not available for 1927, there has probably been a great improvement in suburban and outlying areas of the region. Expressway and other highways that bypass urban concentrations permit much faster trips than the network of town-to-town roads which constituted the suburban highway network prior to World War II. Figure 12 shows travel times for the Boston region.

Summary

Great strides in road building volume and technique and improvements in traffic control have been overtaken by the tremendous sharp increases

BOSTON REGIONAL SURVEY

12



HIGHWAY TRAVEL TIME FROM DOWNTOWN BOSTON

IN RUSH HOUR

- ▬ ▬ ▬ ONE HOUR
- ▬▬▬ 30 MINUTES
- ▪▪▪▪▪ 30 MINUTES (1927 WHITTEN REPORT)

SOURCE: M.I.T. STUDENT PAPERS

GENERAL INFORMATION

- EXPRESSWAYS
  - ▬ ▬ UNDER CONSTRUCTION
  - ····· PROPOSED
- MAJOR HIGHWAYS
- SECONDARY HIGHWAYS
- MAJOR RAILROADS
- SECONDARY RAILROADS
- RAPID TRANSIT LINES

NORTH

2560 ACRES

1

SQUARE MILES

0 5 10 MILES

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in motor vehicle registrations and usage. Congestion in the core cities, a subject of great concern over thirty years ago, has not been alleviated except in isolated cases. Future improvements and additions to the expressway system in the core will probably accommodate only a small portion of the total travel demand.

In addition to traffic problems in the core area, congestion has become serious in some suburban communities and in the outlying cities. A large part of the region's expected increase in vehicle mileage is expected to occur in the suburbs. This will intensify traffic problems in areas which have hitherto not been a source of concern to the region.

5. STATUS OF THE EXPRESSWAY SYSTEM

The expressway system, as conceived in the Master Highway Plan of 1948, has been essentially adopted as the official regional expressway plan. Only limited modifications have been made in the plan since 1948. As the region's future highway needs will change, subsequent modifications and additions to the expressway system will be needed.

Many of the expressways in the region (225 miles out of over 400 miles) are part of the National System of Interstate Highways which is scheduled for completion by 1972. If this schedule is followed, all sections of the region's Interstate expressway system will be completed by that date. As of the fall of 1961 the Department of Public Works estimated that in terms of route mileage the Interstate program in Massachusetts was 48 per cent completed. An additional 9 per cent was under construction, 23 per cent under design, and 20 per cent was in the process of survey, mapping and basic study. The primary reason for the large percentage of completed expressway on a statewide basis is that the Massachusetts Turnpike (123 miles) is designated as part of the state's Interstate route mileage.

Remaining routes which fall under other federal-aid highway programs do not have a 1972 deadline and will be built as funds become available. Funds for these roads are limited. In 1961 the state received only $14.4 million for these other federally aided highways, commonly referred to as the ABC system as compared to $65 million for Interstate roads. On the 50-50 federal-state matching basis governing ABC construction a total of $29 million was allocated to ABC road construction in 1961. There has been a steady increase in the amount of money spent for highways, but a lesser growth in total of new highway mileage because of increased construction and land taking costs -- large sums are required for relatively short segments of expressways built within urban areas. Also, some

construction funds recently have been spent for widening and improvements on existing highways rather than on new route mileage. For example, the widening of Route 128 will cost an estimated $29 million, all of which must come from the ABC program.

Figure 13 shows the estimated completion schedule of the regional expressway system. Project completion data relating to roads that are currently under construction has been obtained from the Department of Public Works. Project completion dates for highway sections in the planning, design or study stage or which have been proposed for construction have been estimated.

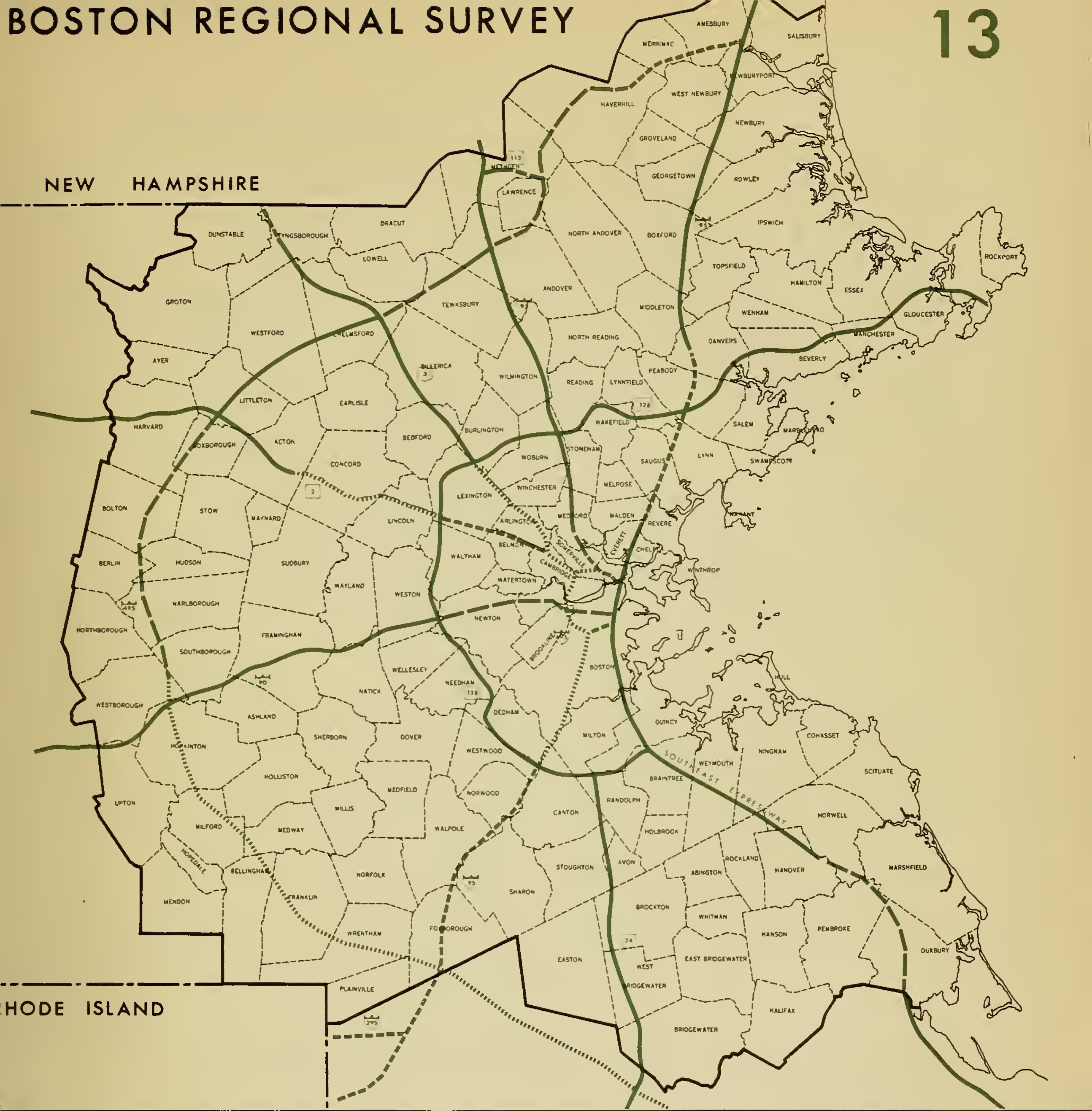
Route 1-95 North

This road is an extension of the Central Artery in Boston which runs northward and connects directly to the New Hampshire Turnpike. A major portion of this route, 21 miles between Danvers and the New Hampshire state line, was opened to traffic in the mid 1950's. At the time of construction this segment was not specifically a part of the Interstate system and the highway geometric design standards used were slightly below those ultimately adopted for the Interstate system. While this section of the highway is an excellent four-lane divided facility, the DPW estimates that an additional $7.6 million will be needed to bring the roadway up to Interstate standards. Since the road now provides satisfactory service, the design upgrading will probably be given low priority.

North from Boston via the Central Artery, 1-95 uses the Mystic River Bridge and is completed as far north as Revere, adjacent to the abandoned Revere airport. Between this point and Danvers, only basic planning studies have been made. There is no great pressure for speedy completion since the terminal points in Revere and Danvers are connected by a four-

BOSTON REGIONAL SURVEY

13



STATUS OF THE EXPRESSWAY SYSTEM

——— EXISTING EXPRESSWAYS

— — — COMPLETION BY 1965

- - - - - - COMPLETION DURING 1965–1970

·············· COMPLETION AFTER 1970

SOURCE: ESTIMATES BY TPSG

PREPARED FOR THE MASS TRANSPORTATION COMMISSION

BY THE PLANNING SERVICES GROUP, CONSULTANTS

GENERAL INFORMATION

☐ EXPRESSWAYS

UNDER CONSTRUCTION

PROPOSED

☐ MAJOR HIGHWAYS

☐ SECONDARY HIGHWAYS

☐ MAJOR RAILROADS

☐ SECONDARY RAILROADS

☐ RAPID TRANSIT LINES

▲ SYMBOL APPEARS ONLY WHEN LISTED ITEM IS SHOWN ON MAP

△ NORTH

2560 ACRES

1

SQUARE MILES

0 5 10 MILES

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to six-lane divided section of Route 1. While traffic on this section of Route 1 is complicated by a great deal of commercial roadside development, advanced design features of the highway, such as left turn lanes, median strip and grade separated intersections keep capacity and operation at a satisfactory level. A major bottleneck on this route was eliminated in 1962 when the intersection of Route 1 and 128 was rebuilt from a conventional cloverleaf design to a high-speed interchange with direct ramps connecting the two highways.

In recent years the quality of traffic flow along this route has improved considerably with the removal of major bottlenecks. Construction on the final link between Revere and Danvers will probably take place during the 1965-1970 period.

Route 1-93

This highway will begin at the Inner Belt in Boston and extend northward beyond the Lawrence area into New Hampshire. The 24-mile link between Medford Square and the New Hampshire state line is now completed and open to traffic. In New Hampshire the road is completed as far as Rockingham Park Race Track. This section has helped to accommodate heavy seasonal recreation traffic destined for New Hampshire. A reduction in traffic volume has been particularly apparent along Route 28, the road formerly used by this traffic.

Construction is now proceeding on a section of the expressway south of Medford Square near the Mystic River. It is unlikely that further inward construction will take place until the fate of the Inner Belt has been decided. Somerville, through which the final leg of I-93 would have to pass, is one of the communities that has used its veto power to prevent construction of the belt highway on the right-of-way proposed by the DPW traffic consultant.

The present terminal of the Interstate highway at Route 16 is convenient as a temporary ending of the road. Sections of Route 16 have been improved to handle increased volumes of traffic. Once the Inner Belt question is decided, it is quite possible that construction of the final extension of I-93 and the northern arc of the Inner Belt would proceed simultaneously. In any event completion of I-93 into Boston would probably not take place until the middle of the 1965-1970 period.

Route 3

At the present time, Route 3 is a completed four-lane divided expressway between Route 128 in Burlington and a point in Tyngsborough three miles south of the New Hampshire state line. Although this section of roadway has been open to traffic for some time, work on the extension into Boston as proposed in the 1948 Master Highway Plan and by the DPW has not proceeded. One reason for the delay is that this extension will require taking expensive homes in Lexington, Winchester and Arlington. The road also may pass through some community owned open land, a move which is opposed by preservationist groups.

Since this highway would be financed under the financially limited ABC program, a start on the inward extension from Route 128 may not be made for some years. The 1962 State legislature, in passing the accelerated highway program bill (Chapter 782, 1962), authorized and directed the DPW to construct this section of roadway but no funds were specifically allocated and no time limit was set for beginning of construction or completion of the road.

Several studies have been made showing possible routes that might be followed for new Route 3. The recently released Inner Belt study shows several alternate routes. The one which was recommended in the Inner

Belt report would utilize the section of Route 2 along the Arlington-Belmont line between east Lexington and West Cambridge.

Because of strong objections to any of the proposed alignments in this area, the heavy land-taking costs involved, and the limited amounts of funds available, the route will probably not be completed until the 1970-1975 period.

The northern end of Route 3 in Tyngsborough will probably be completed sooner than the Boston extension. The four-lane expressway ends at a two-lane road which connects to old Route 3 whose cross section varies between three and four narrow lanes. Originally three lanes wide, a recent project widened the roadway in Tyngsborough to permit a four lane cross section, apparently as an interim measure. In contrast, in New Hampshire Route 3 is four full lanes wide, and about two miles north of the New Hampshire state line the route ties into the Everett Turnpike. It is estimated that this short final connection between the Route 3 expressway and the Everett Turnpike will probably be made in 1965-1970 period. To delay construction beyond this period might necessitate improvements to existing Route 3 in Tyngsborough, improvements that would be expensive and would later be made obsolete by the extension of Route 3 to the Everett Turnpike.

Route 2

This route enters the region from the west as a four-lane divided expressway, reaching into the core where it connects to Memorial Drive in Cambridge. As it continues into the core the cross section becomes progressively poorer. Between the four-lane divided section which ends at the Concord Reformatory in west Concord and Route 128, reasonably high design standards prevail although there are no medians or left turn

lanes. This route is usually not congested even during peak traffic periods. At the present time no designs have been prepared for improvements to this section. Between Route 128 and Route 16 (Alewife Brook Parkway) in west Cambridge the road continues as a four-lane highway with several grade intersections controlled by traffic signals. The section of the road which passes through Arlington and Belmont has a median strip, carries about 30,000 cars per day, and is frequently congested during peak periods.

Plans are well under way to upgrade this section of Route 2 from a four-lane undivided highway with no access control to a limited access, eight-lane divided expressway. There will be no crossings at grade and service roads will be provided along those sections where intersecting streets are frequent. At least one three level interchange has been proposed at an important crossover at Route 60, however this design has not been finally adopted.

If the recommendations of the Inner Belt and Expressway System Report are followed, this roadway would also carry Route 3 traffic between the Arlington-Lexington line and Route 16.

Land taking along this section began in late 1962 but a final construction schedule has not been established. Surprisingly few land takings are involved considering the length of the improvement and the high density residential areas on both sides of the highway. Construction will probably start inward from Route 128 because improvements in this area would tie in with the current widening of Route 128. Construction will probably begin in 1963 or 1964, but a final connection to the Inner Belt will be delayed until that route is built or under construction. Completion of the new expressway between Route 128 and Route 16 will probably take place in the

middle of the 1965-1970 period. Between Route 128 and west Concord, improvements will probably not be made until the 1970-1975 period.

The Massachusetts Turnpike, I-90

One of the most recently begun expressway projects in the Boston region is the twelve-mile Extension of the Massachusetts Turnpike. This expressway will extend from the terminus of the present Turnpike at Route 128 into Boston, connecting with the Central Artery in the vicinity of South Station. The highway will consist of two, three- or four-lane roadways. The eight-lane section will extend between Huntington Avenue and Center Street in Newton.

Construction of the Turnpike Extension was begun in early 1962, has proceeded at a rapid rate and the Turnpike Authority expects completion by March, 1965. Although the road is being built as a toll facility it will be an important link in the Interstate System, and a vital segment of the region's highway network.

Route I-95 South

I-95 which is termed the Southwest Expressway will replace Route 1 to Providence as the major highway connection between New England's two largest metropolitan areas. Ultimately, I-95 will connect with the Connecticut Turnpike (I-95) via the Providence belt route (I-295) and Rhode Island I-95. This will provide an alternate southern route to New York comparable to the heavily used northern route via the Massachusetts Turnpike and Route 15 to Connecticut.

Progress along I-95 south in Massachusetts varies. Some sections are under construction while others are in the basic study phase. Construction is proceeding in a northerly direction with most progress in

the southernmost portions of the route in the Attleboro area. Between the Rhode Island state line and the Foxboro-Mansfield line a ten-mile section of the road was under construction in the fall of 1962. Construction of this ten-mile section terminates at approximately the location where the Outer Belt (I-495) will ultimately connect with I-95. In late 1962 some portions of this segment under construction had been completed except for a permanent pavement which has not been applied since this segment does not as yet tie in with existing highways.

From the present end of construction on I-95 to a point along the Sharon-Walpole line, an eight mile extension will be placed under construction in 1963. When this section is completed, probably in 1965, the surface of the southerly section should also be completed, opening up about 17 miles of new expressway. The end of this new construction will be at an interchange with Route 1 in Sharon, and will provide a convenient switching point for express traffic.

During the next stage of construction it is expected that right-of-way takings will begin on the section between Sharon and Route 128. I-95 for the 27 miles between the Rhode Island line and Route 128 will probably be completed in the middle of the 1965-1970 period.

Between Route 128 and the Inner Belt I-95 will probably be completed toward the end of the Interstate program. Several basic studies of this stretch have been made but a number of problems remain unresolved including the precise linkages with Boston urban renewal areas and the possible combination of rights of way for rapid transit and railroad and highway facilities. In addition, the large scale land taking involved in construction of the recommended route has already resulted in opposition from property owners and neighborhood groups.

Although there has been some discussion of the possibility that the

Southwest Expressway be built as a toll facility from Route 128 to the Inner Belt, no specific recommendations or actions have been taken. One reason for construction as a toll highway would be to provide funds for early completion of the roadway. In this case it may be completed considerably before 1972.

Southeast Expressway

The first and only expressway to date to penetrate the core completely and tie in with a section of the Inner Belt (the Central Artery) is the Southeast Expressway. Outward from the Central Artery the road is completed as a six-lane divided highway as far as Route 128 in Braintree. Between this point and Route 3 near the Duxbury-Kingston Line the road is under construction with completion scheduled for the end of 1963. This section of Route 3 between the completed sections of the expressway in Braintree and Plymouth is frequently heavily congested during summer recreation peaks, a situation which will be remedied only when the final link in the road is completed. The Southeast Expressway ends in Duxbury where it connects with Route 3, but Route 3 as far as the Cape Cod Canal is built to expressway standards as a continuation of the Southeast Expressway. By 1964 an expressway route will be available from Boston to the Mid-Cape highway, (Route 6), already built to expressway standards.

The inner section of the Southeast Expressway was completed in 1960. This highway has enabled many rail commuters to transfer to automobiles. Discontinuance of the Old Colony line resulted in capacity-plus volumes ever since the road was opened for traffic. During peak hours, morning and evening traffic volumes are very heavy with frequent periods of congestion.

Route 24, The Fall River Expressway

The portion of this highway (which extends south from Route 128 to Fall River and, via Route 140, to New Bedford) within the Boston region is complete. Although Route 24 does not extend inward from Route 128, traffic from southeastern Massachusetts has a continuous route into the core via Route 128, the Southeast Expressway and the Central Artery.

Route 128

The first circumferential highway around Boston and one of the first in the nation, Route 128 has achieved national prominence because of the extensive industrial development which has taken place along its route.

Original sections of the highway near Route 1 in the Peabody area were completed prior to 1950. The road was a four-lane controlled access route with some driveways and intersections at grade. As Route 128 progressed southward the new sections were built to higher design standards. It became a four-lane limited access facility as far south as Route 9. Beyond this point, the design was further upgraded when traffic grew beyond all expectations on the completed portions; six lanes were provided between Route 9 and the Southeast Expressway.

When it became apparent that traffic demand had strained the road's existing capacity, widening of Route 128 was begun in 1958. By the summer of 1962, the entire section to be widened was under construction or had been completed. A completed, unobstructed Route 128 may be ready by 1964. Between Route 3A and Route 9 to the south, Route 128 will be eight lanes wide and to the north six lanes wide from 3A to Gloucester. South of Route 9, the six-lane highway originally constructed will probably be adequate to serve projected traffic volumes.

Route 495, The Outer Belt

This highway along the boundary of the Boston region arcs from I-95 south to I-95 north, a distance of 88 miles. It runs in a radius of about 25 miles from the center of Boston except in the Merrimack Valley where it follows the Merrimack River and intercepts I-95 north in Salisbury; at this point it is approximately 35 miles north of Boston.

Up to the end of 1962, construction on I-495 was concentrated on the northern arc from Route 9. No major segment of the route is open at the present time. A four-mile section between Route 9 and Route 20 is expected to be completed by June, 1964. Between Route 20 and Route 111 in Boxborough, final designs are being prepared and construction will probably begin in 1964. Between Route 111 and Route 2, construction was under way in late 1962 and is expected to be completed by early 1964. Between Routes 2 and 3 the highway segment was completed in late 1961.

Between Routes 3 and I-93 the road is either completed or in advanced stages of construction and the section between these highways will probably be ready for use in 1963. From I-93 along the Merrimack River to Haverhill construction of bridges across the river is well advanced. Construction on the land connections will be begun in late 1962 as far as Route 110 north of the center of Haverhill. Between this point and the northern terminus of the Outer Belt at I-95 in Salisbury final designs are being prepared but construction will probably not begin before 1965.

In summary, of the 61 mile northern arc of the Outer Belt, the section between Routes 2 and 3 is completed, the section between Routes 3 and I-93 will be completed in 1963, and the central Merrimack Valley section between Route I-93 in Andover and Route 110 in Haverhill will probably be completed in 1965. The latter will provide a continuous route between

Route 2 in Littleton and Route 110 in Haverhill. Route 110 between this point and I-95 north will provide reasonably good service until the final link is ready. The final connections south to Route 9 will probably not be completed until 1966. and the final northern link will probably be completed before 1970.

Work on the 26-mile southern arc between Route 9 and I-95 in Foxborough has not proceeded beyond the preliminary survey and mapping phase. Because of the lack of any specific plans, and because of the priority given to other highways, this section of the Outer Belt will probably be one of the last projects started under the current Interstate program in Massachusetts. Completion before the middle of the 1970-1975 period is unlikely.

Route 695, The Inner Belt

This route has been the subject of a great deal of controversy. While extensive studies have been made analyzing the location, cost, potential traffic service and social and economic implications, progress on the route has been slow. Only a half-mile section of the seven-mile route is under design and a 1.3 mile section is in the survey and mapping stage. Both of these sections are in Boston. These figures do not include the Central Artery which will serve as part of the Inner Belt route.

A major study of the route was published in September, 1962. The lack of progress on the Inner Belt is not directly related to the results of this special study. In 1960 the State legislature passed a bill giving certain communities a veto power over the location of the route within their jurisdictions. These communities include Cambridge, Somerville, Brookline, and Boston, the four to be traversed by the Inner Belt. While Boston initially agreed to a tentative location in Charlestown and Roxbury, Brookline Cambridge and Somerville have objected to the proposed route because of

the anticipated disruptive effects on established neighborhoods and have effectively used the veto power to block construction. Cambridge and Somerville officials have protested that in its recommended location the route would require extensive land takings which would remove substantial amounts of taxable property and dislocate about 4,000 families.

It can be assumed that eventually a workable solution will be found to the Inner Belt location problem. However, as a result of delays it will probably not be completed until the 1970-1975 period, although some segments, particularly those in Boston, may be completed sooner. A mile-and-a-half section in the Charlestown area will probably be built first, coordinated with urban renewal activities in that area. An additional short segment in Somerville will be needed to connect I-93 to the Central Artery. Somerville's approval of this segment would solve a major problem in this area -- the dumping of express traffic on an already overburdened local street system. At the moment, however, no approval has been given by the city of Somerville for this segment of the road.

Summary

The expressway system in the Boston region as originally proposed in the 1948 Master Highway Plan and in its subsequent revisions will probably be completed by 1975. Included in this major construction effort are all segments of the Interstate system located within the region including the Massachusetts Turnpike, Federal-aid primary routes 2, 3, 24, and 128 and the Southeast Expressway.

The Massachusetts Turnpike Extension will be the second expressway to penetrate the downtown Boston area, the Southeast Expressway being the first to do so. The Turnpike Extension however, will be the first expressway to penetrate downtown Boston from the west, with the consequent

result that despite its toll charges, the road may attract large traffic volumes soon after its completion.

Although the widening of Route 128 will be completed prior to 1965, the other two circumferential highways, the Inner Belt (I-695) and the Outer Belt (I-495) will not be completed for another ten years: The construction of both facilities is being staged so that final links will not be completed until after 1970. The Outer Belt from Route I-95 in Salisbury to the Massachusetts Turnpike will be completed before 1970, and will have a significant impact on the region although the southern arc of the circumferential will probably not be completed until a few years later.

By 1965 a series of highways composed of Interstate Routes I-93, I-495 and Route 113 will form a circumferential highway around the City of Lawrence. This circumferential highway will be the first complete ring circumferential to be built in the state, and will provide the Lawrence area with substantial advantages. However, the lack of access roads from the highway to the downtown section of Lawrence poses a serious problem for the Lawrence area. Consideration has already been given to possible methods of handling expressway-oriented traffic and for providing access to the downtown area, but no funds are yet available for the construction of necessary local arterial facilities.

Although Lawrence presents a unique situation with its circumferential highway, Lawrence's access problems are indicative of those the region will face as the expressway system nears completion. Many communities will be faced with the problem of improving local access to the expressway system in order to relieve congestion and to take advantage of the time savings the expressway system offers. Although the expressway system of the region was proposed fourteen years ago and its construction was financially

assured by the highway act of 1956, insufficient planning has gone into the local arterial street systems needed to furnish access to expressways. In addition, little serious consideration has been given to possible methods of financing local arterial street systems. The exception is the recently completed North Terminal Area Study, however, this study covers only a very small portion of the region. Also, the Boston Redevelopment Authority has undertaken studies for arterial street connections to expressways within the city of Boston.

The study of the transportation requirements of the Boston region by the Mass Transportation Commission will probably result in recommendations for certain additional highway facilities to be built during the next twenty to thirty years. The location of these facilities and their priority and their cost will be known after completion of the regional transportation study in December, 1964.

6. SUMMARY

Over a period of more than 300 years the regional highway system has evolved from narrow Indian Trails to modern multilane expressways. Because the highway system has developed over such a long period, its character and design differ radically from the more formal and defined system of railroads, street cars and rapid transit. The highway system has developed under public control except during the turnpike construction era of the early nineteenth century. At first, public control over highways was haphazard and minimal but as the need for highways increased toward the beginning of the twentieth century, more formal control was initiated. Subsequently, federal participation in highway construction strengthened the role of the state highway departments. In Massachusetts as in other states, the Department of Public Works became responsible for the expenditure of all federal as well as most state highway funds. However, in addition to the Department of Public Works other agencies, particularly the Massachusetts Turnpike Authority and the Metropolitan District Commission, also have jurisdiction over highways in the region.

Finances

Federal and state highway spending will probably continue at a high level for the next several years as construction on the Interstate system progresses. This program is financed principally by federal and state gasoline taxes. While the state tax in Massachusetts has remained at 5.5 cents per gallon since 1957, the federal tax has increased from 2 cents per gallon when the Interstate program was initiated in 1956 to 4 cents at the present time.

The Interstate Highway Program is scheduled for completion by 1972. During the next five years, highway spending in the state will probably rise to a peak, then will level off and decline as the Interstate system nears completion. After 1972 new highway construction will be seriously

hampered in urban areas by the lack of space and family relocation problems. While additional money may be spent on highways after 1972, it may be spent for major reconstruction of facilities on existing rights of way. Todays highways, are constructed at previously unheard of costs of $10 - 15 million per mile in urban areas, but tomorrow's highways will be even more expensive primarily because of the high cost of traversing densely built up urban areas. New highway facilities may be limited to tunnels or viaducts over existing transportation facilities such as railroads or highways.

Another major input of funds may be required for the automation of existing expressways to improve their efficiency and safety. Several experiments involving sections of radar or radio-controlled highway have been successful and new systems are continuously being proposed and tested. The state DPW has ask that the federal Bureau of Public Roads use Route I-93 between Medford and The New Hampshire Line and I-95 south from Boston to Attleboro as test highways for such experiments. In any event, it is likely that more highway funds will be spent on fewer miles of new roadway.

In addition, maintenance costs, already mounting very rapidly, will also account for a larger portion of highway expenditures. The region is beginning to experience the high costs of expressway maintenance and operation. These costs are likely to increase very rapidly because many new miles of expressway will be added to the system and existing expressways will require increased annual maintenance as they age.

Local communities also will be faced with the problem of increased maintenance costs, particularly in areas where a great deal of subdivision activity is taking place. While initial construction of subdivision roads may be financed by developers, after acceptance their operation and maintenance becomes the responsibility of the municipality.

Expressway Access

Supported by federal and state funds, the expressway system has expanded rapidly. Meanwhile, arterial streets of the region which have received less financial assistance have been neglected. Access to expressways via arterial streets is a serious problem in the core cities. Even in suburban areas along Route 128, many of the expressway approaches are congested at peak hours while traffic on the expressway itself flows smoothly. This is particularly true at those interchanges which serve concentrated industrial and commercial development.

The lack of strong financial support has been only part of the problem. In many cases where expressways have been built or proposed there has been no effort to develop arterial connections to the interchanges.

Arterial Street System

While many communities have adopted comprehensive master plans which include arterial street plans there has been a lack of coordination among communities in designating these streets. The region's urban areas are honeycombed with a pattern of short-cut routes which have evolved because of the lack of an efficient arterial street program. Also, because suburban communities have neglected to designate and improve arterial routes, many narrow suburban roads experience unusually high traffic volumes. This has led to rapid deterioration of pavements designed for light traffic loads.

Suburban Business Districts and Town Centers

The rapid decentralization of retail trade during the past decade has resulted in the creation of a number of small shopping centers throughout the region. Usually located on already busy arterial streets, they have compounded suburban traffic volumes and have engendered congestion. Moreover, rapid increases in suburban population and vehicle registrations have helped to create traffic and parking problems in nearly all town centers in the region.

Construction of bypasses around town centers and other congestions points have been suggested in certain localities. However, this type of solution does not appear to be acceptable to many towns. The heavy expense of land takings and construction and the location problems which a bypass usually entails preclude this approach except in isolated cases. Continued congestion at intersection points in town centers hinders the development of an efficient highway system in suburban and rural parts of the region. This is a particularly important problem since a large portion of the projected increase in the region's automobile mileage is expected to occur in the suburbs.

Coordination with Public Transportation Facilities

Highway improvements in the past have been exclusively aimed at solving highway problems. However, it has become evident that the highway system cannot be isolated and planned as a discrete transportation element, but must be approached in the context of a balance with public transportation. This balance is difficult to achieve because of competition between transportation facilities, but methods must be developed to ensure that each mode of transportation in the region is planned, designed, built and utilized to provide the service for which it is best suited. Also, the various modes should complement each other where this is desirable and useful. This can only be accomplished through coordinated planning and implementation among the major transportation agencies.

Interchange points between various modes require particular attention. To a degree, the region has already benefited from efforts of this type. For example, the MTA and the railroads have attempted to provide parking areas at convenient points along their routes. The New Haven Railroad's Route 128 railroad station in Canton is an excellent example of such a combined effort. The DPW where possible has attempted to provide access from state highways, including expressways. Similar coordination may be indicated in other parts of the region.

It is likely that in the future, additional parking facilities will be provided along existing MTA routes. Moreover, rapid transit extensions require the provision of large parking lots at intermediate stops as well as outlying terminals. Furthermore, although rapid transit agencies will build these parking facilities, access to these lots must be provided by highway agencies. In order for the highways and parking to complement each other there must be a comprehensive development plan for future facilities.

Highway Location in Core Areas

As the limited supply of land in the core areas is depleted, land for expressway construction purposes is becoming extremely difficult to obtain and extremely expensive . Objections to virtually every proposed expressway are being raised by neighborhood groups fearful of the impact of six and eight lane highways.

For example, since the publication of the Inner Belt Report (September, 1962) several public hearings have been held on the proposed location of the Belt route and the Southwest Expressway. At each of these meetings strong local opposition to the expressways was in evidence.

The Inner Belt report concluded that about 7500 families would be relocated as a result of the construction of the Inner Belt and linkage expressways. The Inner Belt alone is expected to displace nearly 4,000 families.

One reason for the strong opposition is that unlike renewal programs, no relocation assistance has been available. Recent federal legislation has provided for relocation payments to families and businesses displaced by highway construction. Up to $200 would be paid to families and up to $3,000 for businesses, a schedule of payments similar to that provided under urban renewal. The DPW is in the process of drafting legislation that will provide this assistance in Massachusetts.

SUMMARY

Despite this financial assistance, the large number of families to be relocated is a serious regional problem, particularly in view of the relocation that will occur as a result of urban renewal activities. Any future highway plans must consider the requirements and effects of family relocation.

Conclusions

This chapter of the Boston Regional Survey has reviewed the development, the plans, characteristics, administration, and other elements of the highway system. As a result of this review, certain deficiences have been noted and potential problems have been identified.

1. Need for new travel data. The most recent collection of basic travel data on a regional basis was done in 1945, immediately following the war. This data reflected wartime conditions and occured immediately prior to the rapid unprecedented increase in automobile ownership and suburbanization following the war. This data is extremely difficult to update. For example, the recent Inner Belt study found the 1945 data unusable as a basis for making traffic projections. A new effort is under way to collect travel data in the region as a basis for comprehensive transportation plans and to store it in a manner convenient for up-dating.
2. Need for a new highway plan. Since 1948 the region has relied upon a basic expressway plan to accommodate increasing traffic volumes. Virtually all of this plan has been adopted and the region is committed to it. Although new expressways and other traffic facilities have been proposed since 1948, none have been extensively tested to determine their feasibility. Just as the Master Plan of 1948 incorporated previous plans and new ideas into a unified highway plan that gave the Boston area a strong advantage when highway funds became available through the Interstate program, a new plan should be prepared to utilize future highway funds efficiently and to

coordinate highway plans as part of a balanced transportation system.

3. Arterial Street Plan. In addition to a new plan for expressways, a system of regional arterial streets should be identified and adopted. The arterial streets should be studied and planned to provide maximum integration with the expressway system and to provide local access. The analysis of the highway system now underway will result in recommendations for improvement of the arterial street system.

4. Financing. The emphasis in current highway financing is on new expressway construction. While this type of construction will continue for the next decade an adjustment allocating highway expenditures must be made to provide increased amounts of money for maintenance and arterial street improvement. Many of these arterial streets are maintained solely by local funds. Unless early action is taken to improve arterials the region will find itself with an express highway system that can be only reached by congested streets and inadequate suburban highways.

5. Highway Coordination Since a number of agencies are responsible for highways in the region coordination at a high level is necessary to ensure that the work of these agencies is not duplicated or in conflict. Such coordination should lead to the most efficient use of available highway funds, both for construction and maintenance.

APPENDIX -- SOURCES OF DATA

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18. Statistical Analysis of Massachusetts Motor Vehicle Traffic Accident Experience. Various years. Massachusetts Registry of Motor Vehicles. Contains information on automobile registrations in the state.

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20. Report on a Union Motor Truck Terminal. Boston City Planning Board, 1947.

21. Vehicle Registration Figures. Massachusetts Department of Corporations and Taxation. This department issues annual total registration figures for each of the cities and towns in the state. The figures include total re-registrations as well as motor vehicles other than cars and trucks. When this data was used it was modified by a factor obtained by relating total actual state registrations with the Department of Corporations and Taxation statewide figure. For example, in 1950, actual

vehicles were only 80 per cent of total registrations; in 1960 only 74 per cent. These factors are probably slightly different in various communities, however, for the purposes of this report, the available data was considered to be sufficiently accurate.

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